

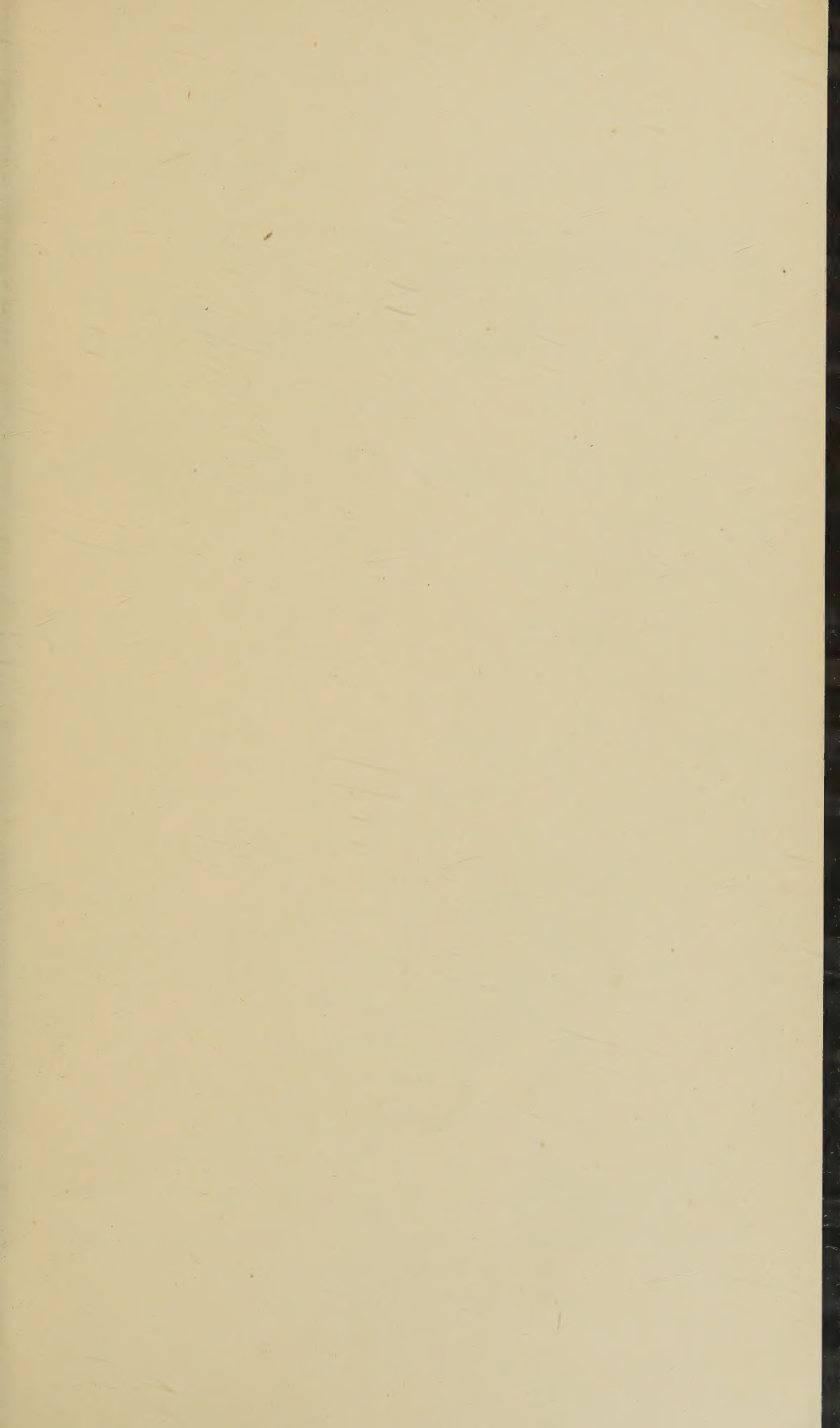
Annual Report
of the
DEPARTMENT OF AGRICULTURE
for the year
1949

by
A. E. S. McINTOSH
Acting Director of Agriculture
Federation of Malaya



FEDERATION OF MALAYA







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APPENDIX I.

COMPARATIVE ACREAGES OF AGRICULTURAL CROPS.

ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE, FEDERATION OF MALAYA, FOR THE YEAR 1949.

SECTION I.

POLICY.

The policy of the Department of Agriculture in the Federation of Malaya, in keeping with Federal and State/Settlement Governments' policies, may be stated in general terms to be to undertake, within the limits of its staffing and financial resources, work directed towards the economic improvement of agricultural production by estates but particularly by smallholders. Improvements are held chiefly to lie along lines of intensification of existing crop and livestock production coupled with an introduction of sound systems of diversified agriculture.

2. With reference to the *intensification* of crop production and having regard to estate agriculture, the situation with regard to the world production and consumption of natural rubber coupled with the threat of synthetic rubber indicates perhaps a policy of intensifying rubber production, thereby reducing production costs in anticipation of future severe competition.

3. With regard to the production of coconuts and copra, there is great room for evolving and applying methods of more intensified production, and the same can be said with regard to oil palm and pineapples.

4. So far as smallholders' agriculture is concerned, intensification of rubber, coconut and pineapple production is equally applicable, and with reference to the first-named crop the need for replacement of old rubber by improved new strains is patent.

5. In the case of smallholders' padi, in many instances a single crop economy, the need for increased yields is pressing both as a means of narrowing the gap between local rice production and imported rice and at the same time of improving the economy of the padi producer.

6. Concurrent with intensification of production, there is an acute need for *diversification* in crop production both in cash and food crops. So far as large-scale capital enterprise production is concerned, estate rubber production may be threatened. Sole reliance on rubber carries with it not only absolute servitude to the economics of the world trade in rubber but also the danger of the rubber tree itself becoming the host of some virulent disease or pest in Malaya. It behoves, therefore, that a search should be made for alternative cash-crops to rubber to be grown separate from rubber (monoculture) or in some mutually beneficial form of association with rubber. The work of the Department of Agriculture in this sphere is thus directed towards a search for alternative crops and their testing both in pure form and in combination.

7. The need for diversification in smallholders' agriculture is even more acute. It is held that rubber or padi production on existing units is not of itself calculated to give economic

security and is probably agriculturally and perhaps sociologically undesirable. Consequently, the Department of Agriculture, while paying attention to achieving the means of intensification of individual crop production, is also concerned with the evolution of systems of agriculture to embrace those crops on an intensified individual production basis and at the same time to combine them, with perhaps livestock and pasturages, so as to give self-sufficient and prosperous units for smallholders. It is appreciated that conversion of existing holdings, at present for the most part both restricted in area and crop production, would be a difficult matter, but it is chiefly with a view to evolving a rational system of development of new smallholders' areas that work on the evolution of sound farming systems has significance.

8. Whereas the establishment of the Department of Agriculture to-day does not differ in any noteworthy respects in numbers and organisation from pre-war days, it is now quite definitely the policy to emphasise research and field investigational work. It is only on a basis of such work that improvements noted in the paragraphs above can be effected. It will be appreciated that research and field investigational work cannot be defined in their scope by State/Settlement boundaries, but must be planned and pursued on a basis of the agricultural requirements of the Federation as a whole. For this reason this work is considered centrally and its execution decentralised to States/Settlements on a basis of priorities in importance of the work and the greatest good for the greatest area. In view of existing inadequate Federal staff for this work and further with a view to serving State/Settlement Governments, State/Settlement staff is partly assisting in this work and States/Settlements are providing parts of their Stations.

9. There is no wish here to belittle the importance of extension and advisory activities. Indeed these are strongly pursued by State/Settlement Departments and the Research Branch. But it is clear that these can only have real usefulness in proportion to the extent and quality of research work. In the order of things, research precedes extension and the latter is dependent on the outcome of the former. It is realised that extension work has outstripped research and it is imperative to put an emphasis on and even further develop research. Thus in the projected Agricultural Development Plan of the Federation of Malaya emphasis is laid on the development of agricultural research.

10. Details of the work of the Department of Agriculture directed towards the ends noted in the foregoing paragraphs are given in Section IV of this Report.

SECTION II.

AGRICULTURE IN THE FEDERATION OF MALAYA.

A.—WEATHER.

11. Rainfall during the year in the West Coast region was, generally speaking, above average. The second half of the year, in particular, was much wetter than usual. In the East Coast region, the North-east monsoon, up to the end of the year, was of average intensity.

B.—CROP REPORTS.

(i) RUBBER.

12. The following table shows comparative acreages under rubber in the Federation since 1940:

RUBBER PLANTED ACREAGES.

Year.	Estates. Acres.	Smallholdings. Acres.	Total. Acres.
1940 ..	2,082,293	1,329,791	3,412,084
1946 ..	1,895,814*	1,319,436*	3,215,250*
1947 ..	1,934,106	1,383,193	3,317,299
1948 ..	1,952,347	1,410,178	3,362,525
1949 ..	1,970,579	1,394,881	3,365,460

13. Production figures for the Federation since 1940 are given below. Before the war, rubber regulation was in force and in 1940 the average release for the year of the basic quota was $88\frac{3}{4}$ per cent. In 1941, 100 per cent. release was permitted, but statistics are available only from January to October of that year.

RUBBER PRODUCTION (IN TONS).

Year.	Estates.	Smallholdings.	Total.
1940 ..	331,589	212,726	544,315
1941† ..	307,424†	188,002†	495,426†
1946 ..	173,515	229,692	403,207
1947 ..	359,865	285,364	645,229
1948 ..	402,907	294,071	696,978
1949 ..	400,009	270,248	670,257

14. Pan-Malayan imports and exports of rubber since 1941 are given in the following table:

PAN-MALAYAN IMPORTS AND EXPORTS OF RUBBER.

Year.	Gross exports.	Gross imports.	Net exports.
1940 ..	772,767	234,319	538,448
1941† ..	688,995†	222,854†	466,141†
1946 ..	558,001	191,090	366,911
1947 ..	953,688	313,549	640,139
1948 ..	979,107	300,091	679,016
1949 ..	899,211	220,141	679,070

15. Despite the continued terrorist campaign, which has had its effect both on estates and smallholdings, production during the year was well maintained, totalling 670,257 tons as compared with the record output for 1948 of 696,978 tons.

16. Prices showed an unfavourable trend during the first half of the year but improved considerably following the devaluation of sterling in September.

* Incomplete. † January-October.

17. Replanting and new planting programmes on estates have been to some extent adversely affected by the low prices ruling for the greater part of the year although many estates continued to work to a planned programme of long term replacement with improved planting material. Little interest has been shown by smallholders in replanting, mainly owing to the financial difficulties involved in a loss of crop over a six-year period. A Committee (The Rubber Smallholdings Enquiry Committee) set up by the Federal Legislative Council to advise on ways and means of assisting smallholders to replant has been unable to report pending the collection of countrywide data relating to smallholding rubber, which was still in progress at the end of the year. In the case of new planting, the smallholder, where land is available, is showing some interest, although not as yet, on any appreciable scale. A grant of \$1,043,875 was made during the year from the Colonial Development and Welfare Fund to cover the provision, at a nominal cost, of approved high-yielding planting material to smallholders engaged in replanting their holding or in new planting operations. The scheme is based on an annual replanting or new planting by smallholders of 50,000 acres and, as far as the provision of planting material is concerned, is now well under way. (*See also Section IV, para. 540.*)

18. The serious competition of the synthetic product in the United States market has resulted in considerable attention being focussed on improving the quality of natural rubber. This has manifested itself in moves to secure, by legislation, stricter control on the packing and grading side and in the direction of sale by specification as opposed to grading by visual standards. A further interesting development has been that of centralised latex collection and processing of smallholders rubber in certain areas which has so far resulted in a marked improvement in the quality of the product in the areas concerned.

19. The prevailing uncertainty as to the future of natural rubber has resulted in considerable thought being given by estate interests to diversification of cropping, on the principle of spreading the risk, and interest is manifesting itself in the form both of monoculture of alternative crops and of inter-cropping of rubber with such.

(ii) RICE.

20. *Season 1948-49.*—The acreage of padi planted constituted a record total of 908,070 acres, well exceeding the previous record of 885,484 acres planted in the 1947-48 season. This increase in acreage may be attributed, as was the case in 1947-48, to the prevailing high price of rice, to the progress of schemes of irrigation carried out by the Drainage and Irrigation Department and to the assistance rendered by the Department of Agriculture in the form of minor works of drainage and irrigation, financed from Food Production funds.

21. The total area of wet and dry padi harvested was 838,970 acres and the total yield 195,063,000 gantangs which is equivalent to 307,180 tons of rice. The reduction in crop as compared with the previous season was almost entirely due to the disastrous drought towards the end of 1948 which affected the major producing areas of the north-west in the younger stages of growth of the crop.

22. The following table gives comparative figures for acreages under wet and dry padi together with total yields since the 1937-38 season:

WET PADI.			DRY PADI.		TOTAL.	
Season.	Acreage.	Yield (gantangs) 000's.	Acreage.	Yield (gantangs) 000's.	Acreage.	Yield (gantangs) 000's.
1937-38	681,410	193,124	44,550	6,020	725,960	199,144
1938-39	700,270	217,290	46,450	8,105	746,720	225,395
1939-40	721,580	210,077	63,870	10,593	785,450	220,670
1940-41	742,600	204,473	77,880	11,451	820,480	215,924
1945-46	684,010	143,303	105,640	6,577	789,650	149,880
1946-47	732,620	162,376	80,930	8,896	813,550	171,272
1947-48	802,730	208,323	82,760	9,523	885,490	217,846
1948-49	842,450	187,130	65,620	7,933	908,070	195,063

23. The following table shows Malayan rice production in relation to imports and consumption. Unfortunately, owing to the incomplete import figures for 1941, and to the reduced imports since the war, no useful comparison can be made with pre-war years when local production was approximately a third of total consumption (as estimated by the sum of local production and net imports). It must be emphasised that the present total consumption is abnormally low; imports are restricted and only a low ration of rice is possible; thus local production would represent a much smaller percentage of potential total consumption.

MALAYAN PRODUCTION OF RICE IN RELATION TO NET IMPORTS AND CONSUMPTION 1939-49.

—	1939.	1940.	1941.	1946.	1947.	1948.	1949.
Net imports (tons) ..	658,653	635,360	538,995	136,434	237,119	449,565	483,391
Production (tons) ..	341,455	335,138	324,210	225,044	257,164	343,065	307,180
Consumption (tons) ..	1,000,108	970,498	863,205	361,478	494,283	792,630	790,571
Percentage of Production to net imports ..	52	53	60	165	108	76	64
Percentage of Production to consumption ..	34	35	38	62	52	43	39

24. Annual Malayan net imports of rice since 1939, are given in the following table which includes broken rice but does not include rice bran and meal and padi.

NET IMPORTS OF RICE INTO MALAYA.
(In Tons.)

Year.	White Rice.	Parboiled Rice.	Broken Rice.	Cargo Rice.	TOTAL RICE.	
					Quantity.	Value.
						\$
1939	460,145	71,209	89,091	38,208	658,653	41,700,744
1940	460,328	77,445	62,825	34,762	635,360	50,896,150
1941	403,599	95,806	22,833	16,758	538,996	58,206,142
1946	133,396	25	3,013	1	136,433	24,530,956
1947	231,095	5,921	104	1	237,119	57,401,711
1948	448,017	102	1,300	146	449,565	184,073,360
1949	472,690	20	10,681	—	483,391	195,329,964

25. The price fixed by Government for the purchase of locally produced padi remained at \$15 per picul throughout the year.

26. Progress continued to be made with the investigations into mechanical cultivation. A mission appointed by the Secretary of State for the Colonies to advise thereon visited the Federation in July and August and their report is awaited. It is already apparent, however, that the peat soils, which form the bulk of the new areas awaiting development as irrigation schemes, are likely to prove difficult from the point of view of mechanical cultivation.

(iii) OIL PALM.

27. The growers of this essentially estate crop continued to benefit from the high prices resulting from the world shortage of vegetable oils.

28. The following table shows the planted area under oil palm together with the production of palm oil and kernels since 1939. At the end of 1949, out of a total of 54 estates, there were 46 estates with a total area of 74,332 acres in production.

PRODUCTION OF PALM OIL AND KERNELS AND PLANTED ACREAGES.

Year.	Planted Area. Acres.	PRODUCTION.	
		Palm Oil.	Palm Kernel.
		Tons.	Tons.
1939 ..	75,825 ..	57,373 ..	10,172
1940 ..	78,256 ..	57,972 ..	9,611
1946 ..	77,458 ..	11,756 ..	931
1947 ..	78,181 ..	39,115 ..	5,737
1948 ..	83,320 ..	45,257 ..	8,471
1949 ..	90,507 ..	50,561 ..	10,459

29. The long term outlook for this crop remains good and is reflected in the applications for suitable areas of land for new planting and by a certain amount of replacement of senescent rubber by oil palm.

(iv) COCONUT.

30. This is largely a smallholders' crop although production by estates is by no means negligible. As in the case of oil palms prices have continued favourable and long term prospects appear to be good.

31. The following table shows the commercial production of copra by estates and smallholdings (the latter estimated) since July, 1948, together with the production of coconut oil and copra cake by oil mills for the years 1947-49.

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.
(In Tons.)

Year.	COPRA PRODUCTION.		Coconut Oil.	Copra Cake.
	Estates.	Small- holdings.		
1947 ..	— ..	— ..	51,186 ..	40,760
1948 ..	19,011* ..	45,608* ..	51,164 ..	37,970
1949 ..	36,957 ..	85,980 ..	63,698 ..	43,300

* July-December only.

32. Net exports of copra and coconut oil since 1939 are given in the following table. The statistics are pan-Malayan and include Singapore :

NET EXPORTS OF COPRA AND COCONUT OIL.

Year.	COPRA.		COCONUT OIL.	
	Tons.	Value.	Tons.	Value.
		\$		\$
1939 ..	34,420 ..	3,321,422 ..	61,360 ..	7,133,925
1940 ..	9,904*..	990,568‡ ..	69,446 ..	8,291,617
1941† ..	32,682*..	813,965* ..	64,945 ..	6,668,318
1946 ..	34,218*..	7,731,995* ..	8,008 ..	4,683,425
1947 ..	45,439*..	14,734,312* ..	41,112 ..	24,668,790
1948 ..	28,624*..	14,018,149* ..	45,245 ..	45,531,182
1949 ..	24,424*..	7,159,041* ..	60,504 ..	54,521,306

(v) PINEAPPLE.

33. Rehabilitation of this industry continued both on the field and the factory sides. This is under the administration of the Adviser, Malayan Pineapple Industry, working, so far as the Federation is concerned, under the Director of Agriculture. The expenses of the post and office of this officer are met from a Colonial Development and Welfare grant. (See also Section IV, para. 536.)

34. On the field side there are now over 16,000 acres planted of which rather more than 5,000 acres are owned by the canning interests and the remainder by smallholders. The total area ear-marked but not necessarily alienated is 25,000 acres which is about half the productive acreage grown before the Japanese war.

35. On the factory side, the canneries further modernised their plant by additional introductions of automatic processing machinery. Six canneries are at present operating under licence. They are by no means operating to capacity owing to the shortage of fruit but an improvement in this respect will occur in 1950 when considerable new areas will come into bearing.

36. Pending the passing into legislation of the recommendations of the Johore Pineapple Committee (appointed by the Malayan Union Government in 1947), the affairs of the renascent industry were controlled by a Provisional Working Party, of which the Adviser, Malayan Pineapple Industry, was Chairman. This Party concerned itself with recommending land alienation on the new peat soils to smallholders and packer interests, with steps for the modernisation of canneries, and with the allocation of packing quotas to licensed factories, and the marketing of the pack.

37. Prices for fruit were agreed on as an outcome of a joint meeting between packers and growers held in April of the year under report. These prices were later confirmed for the rest of the year.

* Net imports. † January to October, 1941. ‡ Net export value. (The figures in this table are pan-Malayan and include Singapore imports and exports.)

38. A total of 38,000,000 lbs. of fresh fruit, nearly all from smallgrowers' areas, as the plantations owned by packers had not then come into bearing, were delivered to canneries.

39. At the beginning of the year the existing contract for 130,000/150,000 cases for sale to the Ministry of Food was in process of being filled and expired on 28th February, 1949. At this date delivery was 12,803 cases short of minimum. Negotiations were opened with the Ministry of Food for further sales and eventually the Ministry accepted a further 100,000 cases at the same price as the previous contract. Shortly after negotiations were opened for further sales with delivery April, 1949-February, 1950, and the sale was concluded for 200,000 cases after a visit to London in July by the Adviser, Malayan Pineapple Industry, and the Chairman of the Central Board. The opportunity was taken for this mission to go to Canada to discuss with officials there problems in connection with marketing Malayan canned pineapple in that country.

40. The total pack for the year came to 321,185 cases of which 299,420 were exported.

41. The following table shows the exports of canned pineapple from Malaya since 1939:

EXPORTS OF CANNED PINEAPPLE.

Year.	Cases.	Value. \$
1939 ..	2,725,279 ..	9,928,416
1940 ..	1,543,492 ..	8,435,768
1946 ..	872 ..	11,568
1947 ..	86,516 ..	2,430,951
1948 ..	145,581 ..	3,652,621
1949 ..	299,420 ..	6,307,169

42. With reference to draft legislation, this during the year was actively considered by the Governments of Federation, Johore and Selangor, these States at present being the only ones concerned with canning pineapples for export.

(vi) TEA.

43. The following table gives particulars of the number of tea estates, planted acreage and reserve land:

TEA—PLANTED AREA AND RESERVE LAND.

Year.	No. of Estates.	Planted Area. Acres.	Area in Production. Acres.	Area of Reserve Land. Acres.
1940 ..	*	8,898 ..	* ..	8,275
1946 ..	52 ..	8,697 ..	3,697 ..	6,448†
1947 ..	57 ..	9,732 ..	3,627 ..	9,122
1948 ..	55 ..	9,516 ..	5,037 ..	7,216
1949 ..	50 ..	9,413 ..	6,100 ..	15,173

* Not available.

† Doubtful.

44. Particulars of production, export and local sales of tea are given in the following table:

PRODUCTION OF MADE TEA, EXPORTS AND LOCAL SALES.
(As reported by Estates.)

Year.	Production.	Exports.	Sold locally.
	Lbs.	Lbs.	Lbs.
1940 ..	1,573,854 ..	662,863 ..	838,876
1941 ..	1,608,173 ..	454,074 ..	899,440
1946 ..	420,532 ..	— ..	405,842
1947 ..	1,242,285 ..	108,069 ..	885,913
1948 ..	2,257,619 ..	641,804 ..	1,447,189
1949 ..	3,233,950 ..	1,853,291 ..	1,606,282

45. The following is an analysis of provisional 1949 statistics for highland and lowland estates:

	No. of Estates.	Planted Area.	Area in Production.	Reserve Land.	Production Made Tea.
		Acres.	Acres.	Acres.	Lbs.
Highland ..	36 ..	5,718 ..	3,893 ..	3,693 ..	1,364,947
Lowland ..	14 ..	3,695 ..	2,207 ..	11,480 ..	1,869,003
Total ..	50 ..	9,413 ..	6,100 ..	15,173 ..	3,233,950

(vii) FOODCROPS AND VEGETABLES.

46. The area under foodcrops and vegetables was reasonably well maintained, slight drops in acreages of sweet potato, sugar cane, colocasia and market gardens being recorded. Action by the administrative and the security forces in connection with squatter areas has, however, of necessity, had some adverse effect. The total acreage at the end of the year was 88,970 acres as compared with 96,839 acres in 1948.

47. Tapioca and sweet potatoes are the major rice substitute crops grown while considerable areas of market gardens exist for the supply of vegetables to the large towns. Of some importance in the latter connection is the Cameron Highlands area which to a great extent specialises in cabbage growing. Production in this area averaged about 1,000 tons monthly in 1949 as compared with 675 tons in 1948.

(viii) ARECANUT.

48. The crop is entirely grown by smallholders and mainly exists in mixed cultivation although there are certain areas where it is planted as the sole crop. Production is in the form of split or sliced nuts, mainly the former. Little interest is being shown in this crop at present.

(ix) COFFEE.

49. The recent high prices for this commodity have benefited the local growers, although there has been no appreciable increase in acreage as a result. Coffee has for years been declining as a crop in Malaya. A few small estates still exist but much of the crop is in mixed stand; in many cases interplanted with coconuts.

(x) DERRIS.

50. Although still fulfilling certain specialised uses, derris as an insecticide has largely been replaced by D.D.T., Gammexane, etc., and planting is now largely confined to the insecticidal requirements of the market garden community.

(xi) FRUITS.

51. Fruit trees in mixed stand are a feature of every *kampong* and the total area planted throughout the country is very considerable. The planting of orchards of individual species continues to increase. Bananas are an important crop, with certain areas specialising in their production, although, in many cases, unfortunately, their cultivation is of a shifting character with evil soil erosion consequences.

52. The development by the Department of Agriculture of the selection and distribution of clonal material of the major local fruits has continued. There is a large demand on the part of smallholders for planting material of clonal origin, which cannot as yet be fully met.

53. Excellent crops of local fruits were harvested during the year in the majority of areas.

(xii) SAGO.

54. This palm is confined to low-lying swampy areas. From the fronds *atap* is prepared while the stems are disposed of either to pig breeders for consumption raw or to sago factories for the production of flour.

(xiii) SPICES.

55. The main spices grown are chillies, *sireh* (betel leaf) ginger and turmeric, mostly in small areas but quite extensive in the aggregate. The world shortage of pepper has resulted in a heavy demand locally for planting material of this crop. Supplies, however, have been extremely limited.

(xiv) TOBACCO.

56. This is an important cash crop in some areas such as market garden areas where it is grown in rotation with vegetables, while it is grown on the East Coast as an off-season rotation crop in the padi areas. In all cases it is grown for local consumption.

(xv) COCOA.

57. Considerable progress was made during the year with the investigation work on cocoa and some 400 acres were planted on Departmental Agricultural Stations and co-operatively with estates for experiment and observation in various parts of the country. Most of these plantings were from seed derived from small plantings of trinitario cocoa planted before the war by the Department of Agriculture.

58. The position has now been reached where certain interests are prepared to take the commercial risk of planting cocoa on an estate scale on the better soils, e.g., the Pahang volcanics and the finer grained granites, and applications have been made for land for this purpose.

59. Introduction of seed of the amelonado variety from West Africa was undertaken during the year; seedlings are being raised in an isolation nursery on Pulau Tekong, an island off Singapore. A grant of \$89,930 has been made from the Colonial Development and Welfare Fund for the development of this nursery. (See also Section IV, para. 543.)

(xvi) MANILA HEMP.

60. This crop is still in the experimental stage, utilising the very limited supplies of planting material which the Department of Agriculture has been in a position to provide for the purpose from the nurseries at its disposal.

(xvii) RAMIE.

61. This is another crop which may be regarded as being still very much in the experimental stage. The success of this crop in the Everglades of Florida has focussed attention locally on the possibilities of the peat soils for ramie cultivation.

SECTION III.

THE DEPARTMENT OF AGRICULTURE—ITS
ORGANISATION AND ESTABLISHMENT.

A.—ORGANISATION.

62. The Department of Agriculture in the Federation of Malaya is, by the very nature of the constitution of the latter, made up of (a) a Federal Department and (b) State/Settlement Departments.

63. Each State/Settlement has its own Department of Agriculture establishment of which a State/Settlement Agricultural Officer is the senior officer. He is responsible to his State/Settlement Government for the work of his Department, for advising on all agricultural matters and for fostering sound agricultural development. These State/Settlement officers, so long as they are posted in States/Settlements, are officers of these Governments. They are posted to and transferred between State/Settlement Governments on the recommendation of the Director of Agriculture with the approval of the Governments concerned.

64. It is clear that, whereas administrative and technical matters such as agricultural extension, advisory and pest and disease control work can be effectively pursued on an individual State/Settlement basis, this is not the case in matters pertaining to agricultural research and investigation. It will at the same time be admitted that no real advances in the agriculture of States/Settlements can be made unless they are based on sound agricultural knowledge and experimentation. The source of fundamental knowledge is the specialised training and research experience of officers in the Research Branch. For best results in agricultural investigational work, this must be coupled with the general training and experience of Agricultural Officers. Research officers are members of the Federal Department and in order that their knowledge can be put to the advantage of the Federation as a whole, they must of necessity range throughout the Federation. This is in fact done and receives the strongest co-operation and support of the individual State/Settlement Governments. At the same time, the Agricultural Officers in the various States/Settlements must be, both in staff and land, in a position to test in the field ideas and findings from fundamental research.

65. From what has been stated above, it will be clear that agricultural research and field investigation throughout the Federation must have a common policy, with due regard for individual State/Settlement requirements, and a rational overall programme for research and investigation work drawn up, organised and pursued. It is in this sphere of work that there can be no individual State/Settlement policies, execution and interpretation. On the other hand, the application of the findings from results is definitely a State/Settlement matter. Accordingly, these activities are considered centrally by a Departmental Standing Committee on Investigations which, appropriately enough, has in its membership, representatives of the Research, Field and Economics Branches. This Committee is under the chairmanship of the Deputy Director of Agriculture and is advisory to the Director of Agriculture. It surveys the agricultural research and investigational requirements of the whole of the Federation and, within the funds and personnel at its disposal, allocates work both of a fundamental and investigational nature to appropriate officers and places throughout the Federation, irrespective of whether the former be members of the Research Branch (Federal) or Field Branch (State/Settlement). This in effect means that State/Settlement officers and also Stations belonging to States/Settlements may be required to pursue such lines of investigation. So far as States/Settlements are concerned in this arrangement, and since it is fully realised that the results of investigational work allocated to any State/Settlement may have valuable application both inside and outside of that State/Settlement, it is considered proper to call on State/Settlement officers to execute or assist in the execution of such work. At the same time and in the absence of sufficient Federal Experiment Stations to meet adequately research and investigational work of pressing importance, it has been necessary to use certain Stations in States/Settlements for this work. Such Stations are financed wholly or partly by Federal funds and the execution of the work thereon is carried out in the main by officers of the State/Settlement establishments. The obvious outcome of the results of such work is to make officers of States/Settlements better informed for advising their Governments and producers in their States/Settlements and for making more effective extension work.

66. The foregoing paragraphs have been written to explain why it is that, although the independence of State/Settlement Departments of Agriculture establishments is clearly recognised, in the interests of the Agricultural Departments of States/Settlements, there is bound to be strong co-operation in matters of agricultural research and investigation between the Federal and State/Settlement Departments. Hence, the establishments of the latter, comprising the so-called Field Branch, are shown as part of the organisation of the Department of Agriculture, Federation of Malaya. This arrangement must persist until such time as if and when sufficient Federal staff and Stations become available to take over all agricultural research in the Federation.

67. With the foregoing explanatory paragraphs, reference is now made to Table I, which gives in chart form the organisation of the Department of Agriculture, Federation of Malaya.

68. Reference to the chart will show that the Department, for purposes of organisation and efficiency in administration, is divided into five Branches. It must be emphasised here that, while these Branches have separate identities, every effort is made to co-ordinate their work, so that overall they achieve most effectively a common purpose, which is the improvement of agriculture in the Federation of Malaya.

69. Of the five Branches, four, that is, Head Office (Administration), Research, Economics and Publications, and Education are staffed and financed Federally, while the remaining Branch, namely, the Field Branch comprises essentially State/Settlement establishments. The exception to this is the establishment of the Tanah Rata Station, Cameron Highlands. This is a Federal Station, staffed by Federal officers (Agricultural Officer, Agricultural Assistant and Agricultural Subordinate). It comes, however, sensibly enough, under the Field Branch and is immediately administered by the Chief Field Officer. The work of the Field Branch is co-ordinated by a Federal officer, the Chief Field Officer, who is responsible to the Director of Agriculture and has his office at Head Office. He is the liaison officer between the Director of Agriculture and State/Settlement Departments.

70. The Director of Agriculture is adviser to the Federal Government in all agricultural matters and from time to time likewise advises State/Settlement Governments. He is, of course, responsible for the smooth and efficient conduct of the Department as a whole.

71. The Deputy Director assists the Director in administrative duties and is immediately responsible for matters of Federal staffing and finance. At the same time, and in order to achieve close co-ordination between the Field and Research branches in all matters of agricultural research, he is chairman of the Departmental Standing Committee on Investigations.

72. The Research Branch is responsible for fundamental agricultural research and advisory work based on such research. The Branch is divided into divisions which are indicated in the chart. The Agronomy Division is being greatly developed, in view of the marked need for field investigational work, and functions essentially in drawing up experimental programmes arising out of the recommendations of the Standing Committee on Investigations as approved by the Director of Agriculture, and in co-ordinating the work of these experiments, in analysing and interpreting their results and making further recommendations to the Standing Committee. These experiments include co-operative experiments with estates as well as purely Departmental experiments. The Research Branch has the control of the only Federal Experiment Station of any consequence, i.e., Serdang, but, as indicated earlier, the activities of its staff range over the entire Federation. This is especially so with officers of the Divisions of Botany, Soils Chemistry, Entomology, and Plant Pathology. The immediate responsibility for the administration of the work of the Research Branch lies with the Chief Research Officer whose office is sited in Head Office near the Research Laboratories.

73. The main duties of the Economics and Publications Branch, which is under the control of the Agricultural Economist, and is sited adjacent to Head Office, may be divided into two

sections (i), agricultural economics to include agricultural statistics, and (ii) the editing, production and management of the publications of the Department and supervision of the Departmental library. The Agricultural Economist is assisted by the Assistant to the Agricultural Economist. It is intended in future that the Agricultural Economist shall devote his full time to studies in the economics of smallholders' agriculture while the collection of agricultural statistics shall be a function of the Chief Field Officer, and the collection of market prices for agricultural produce, the editing, production and management of publications and the supervision of the library shall be the duties of the Assistant to Agricultural Economist.

74. The Education Branch is referable to the College of Agriculture at Serdang. A full report on the College's activities for the year is given in Section 4—C—Agricultural Education.

75. The Public Gardens, Kuala Lumpur, which are close to the Head Office of the Department, have since the liberation been under the administration of the Director of Agriculture, but it is expected that their administration will shortly be taken over by the Municipality, Kuala Lumpur.

B.—ESTABLISHMENT.

76. The strength and nature of the establishment are shown in the chart in Table I.

77. Briefly, the establishment comprises senior officers who are for the most part expatriate officers with appropriate University degrees and post-graduate probationary training. In accordance with post-war policy, Government overseas scholarships are being awarded to qualified members of the junior staff to provide the training undergone by expatriate senior officers and so equip them for occupying senior posts. More detailed reference is made to this in Section 4—C—Education.

78. The staffing position with regard to senior officers during the year was acute. At the end of the year, there were no fewer than 21 vacancies as follows:

- 1 Senior Soils Chemist
- 2 Soils Chemists
- 2 Botanists
- 1 Canning Officer
- 1 Senior Agricultural Officer
- 11 Agricultural Officers
- 1 Agricultural Economist
- 1 Principal, College of Agriculture
- 1 Senior Lecturer.

79. This serious staffing position was aggravated by calls on the staff for emergency duties, and at times the Department was carrying on with a staff of less than half its senior establishment.

80. The remaining technical establishment comprises officers for the most part belonging to the Agricultural Assistant and Agricultural Subordinate Service Schemes recruited respectively from graduates of major and minor courses at the College of Agriculture. Their numbers are shown in the chart and it may be stated in general that their establishments were full during the year.

DEPARTMENT OF AGRICULTURE, 1949.

Organisation and Establishment by Branches (excluding Clerical and Non-technical Minor Posts).

DIRECTOR.

DEPUTY DIRECTOR.

HEAD OFFICE
(ADMINISTRATION) BRANCH.

ECONOMICS AND
PUBLICATIONS BRANCH.

EDUCATION BRANCH
(COLLEGE OF AGRICULTURE).

FIELD BRANCH.

RESEARCH BRANCH.

No.	Posts.	No.	Posts.	No.	Posts.	No.	Posts.	No.	Posts.	No.	Posts.
1	Chief Research Officer	1	Chief Field Officer	1	Agricultural Economist	1	Principal, College of Agriculture	1	Personal Assistant to Director of Agriculture	PUBLIC GARDENS, KUALA LUMPUR.	
7	Heads of Divisions— Senior Botanist Senior Chemist (Soils) Senior Chemist (Soils) Senior Agric. Officer (Agronomy) Senior Entomologist Senior Plant Pathologist Canning Officer	10	Personal Assistant to Chief Field Officer State/Settlement Agricultural Officers	—	—	—	—	—	—		
13	Other Senior Officers	7	State/Settlement Senior Officers	1	Senior Officer	2	Senior Lecturers	—	—	PUBLIC GARDENS, KUALA LUMPUR.	
2	Senior Officers (Leave Reserve)	8	Senior Officers (Leave Reserve)	—	—	—	—	—	—		
15	Agricultural Assistant Service Scheme	92	Agricultural Assistant Service Scheme	—	—	5	Agricultural Assistant Service Scheme (Lecturers)	—	—		
22	Agricultural Subordinate Service Scheme	145	Agricultural Subordinate Service Scheme	—	—	—	—	—	—	1 Horticult. Assistant	
9	Miscellaneous Junior Technical Posts	—	—	3	Miscellaneous Junior Technical Posts	—	—	—	—		
	69 Posts		264 Posts		5 Posts		8 Posts		3 Posts	1 Post	

81. In the Research Branch, these technical assistants are assistants in the various Divisions. The miscellaneous junior technical posts noted in this Branch comprise Laboratory Assistants in the Research Laboratories and the Federal Canning Research Station in Johore Bahru, and Field and Factory Overseers at the Federal Experiment Station, Serdang.

82. The technical assistant staff in the Field Branch carries out extension work in States/Settlements, supervises and executes work on State/Settlement Agricultural Stations and Padi Experiment Stations and Padi Test Plots and carries out in part field investigational work on State/Settlement Stations of a Federal nature.

83. The miscellaneous junior technical posts referred to under the Economics and Publications Branch comprise the Librarian, and the Chinese and Malay Translators.

84. The technical assistants under the Education Branch comprise men in the Agricultural Assistant Service Scheme who function as lecturers both to major and minor course students, penghulus and Malay school teachers.

85. The Public Gardens, Kuala Lumpur, are under the immediate charge of a Horticultural Assistant who is on the same rating as an Agricultural Assistant.

C.—SENIOR STAFF CHANGES.

(i) BRANCH HEAD POSTS.

86. (a) *Head Office (Administration)*.—Mr. R. G. H. Wilshaw, Chief Research Officer, continued to act as Director of Agriculture until he proceeded on leave on 23rd April, 1949, when Mr. R. G. Heath, Chief Field Officer, was appointed to act as Director. Dr. A. E. S. McIntosh, Deputy Director of Agriculture, returned from leave on the 19th September, 1949, and was appointed to act as Director with effect from the following day.

87. H. H. Tengku Yaacob ibni al-marhum Sultan Abdul Hamid, c.m.g., Senior Agricultural Officer, acted as Deputy Director of Agriculture until he proceeded on leave in April, 1949. Thereafter, the post was vacant until Mr. R. G. Heath, Chief Field Officer, was appointed to act as Deputy Director on the 20th September, 1949, on the return of Dr. McIntosh.

88. (b) *Field Branch*.—The post of Chief Field Officer was filled by the substantive holder, Mr. R. G. Heath, until the 23rd April, 1949, when Mr. E. J. H. Berwick, Agricultural Officer, was appointed to act in the post. Mr. J. R. P. Soper, Senior Agricultural Officer, returned from leave on the 18th September, 1949, and was appointed to act as Chief Field Officer, with effect from the 20th September, 1949. When Mr. Soper was transferred to Tanganyika, Mr. Heath assumed duty in the post in addition to his duties as Acting Deputy Director of Agriculture.

89. (c) *Research Branch*.—Dr. T. A. Buckley, Senior Chemist, continued to act as Chief Research Officer throughout 1949.

90. (d) *Agricultural Education Branch*.—Mr. J. R. Curry, Senior Agricultural Officer, continued to act as Principal, College of Agriculture, until he proceeded on leave on the 29th January, 1950, when Major O. M. Lee, Senior Lecturer, was appointed to act as Principal.

91. (e) *Economics, and Publications Branch*.—Mr. H. L. Barnett, Registrar of Statistics, Federation of Malaya, continued to act as Agricultural Economist during the year in addition to fulfilling the duties of his substantive post.

(ii) RECRUITMENT.

92. Mr. J. Chattaway, B. Sc., was appointed to be an Agricultural Officer in the Malayan Agricultural Service on the 21st October, 1949.

93. Mr. D. W. M. Haynes, B. Sc., was appointed to be an Agricultural Officer in the Malayan Agricultural Service on the 18th November, 1949.

(iii) TRANSFERS.

94. Mr. D. G. Jones, Agricultural Officer, was transferred to Tanganyika as an Agricultural Officer with effect from 11th October, 1949.

95. Mr. J. R. P. Soper, Senior Agricultural Officer, was transferred to Tanganyika with effect from 21st November, 1949, on promotion to the post of Deputy Director of Agriculture, Tanganyika.

(iv) RETIREMENT.

96. Mr. F. C. Cooke, Canning Officer, proceeded on leave prior to retirement on the 28th June, 1949, and was subsequently appointed Director of the Coconut Research Scheme at Lunuwila in Ceylon.

SECTION IV.

WORK OF THE DEPARTMENT OF AGRICULTURE.

A.—RESEARCH AND INVESTIGATION.

97. Fundamental agricultural research, to include plant breeding, soils, entomological and plant pathological investigations, is carried out by the Research Branch whose officers, though stationed at the Research laboratories near Head Office, work on research problems throughout the Federation. Agronomic investigations are carried out by the Field Branch and the Research Branch. The latter concerns work done at the Federal Experiment Station, Serdang, and the co-ordination, through its Agronomy Division, of work done by State/Settlement Agricultural Officers in States/Settlements, the former is conducted in States and Settlements on State and Settlement Agricultural Stations financially assisted from Federal funds or on a co-operative basis with estates and smallholders.

98. In this sphere of the Department's activities the closest collaboration between the Research and Field Branches is essential and this is achieved through the Departmental Standing Committee on Investigations under the chairmanship of the Deputy Director of Agriculture. This Committee comprises members of both Branches. It considers for the Federation and advises the Director on research and investigation policies, organisation, allocation of work and interpretation of results leading to formulation of further lines of work.

99. Several minor investigational problems of purely State/Settlement significance exist, such as padi variety, sweet potato and groundnut tests for local conditions. These are essentially State/Settlement matters and are carried out and financed solely by State/Settlement Governments. Such investigations are, however, usually based on advice from the Standing Committee or Heads of Research Branch Divisions.

(i) NATURE AND DISPERSAL OF RESEARCH AND INVESTIGATION.

100. To give some idea of the nature and dispersal of research and agronomic investigations in States/Settlements during the year under report, short notes are given here under State/Settlement heads.

101. *Perlis*.—Investigational work on improved strains of padi was carried out at the State Seriab Padi Test Station which replaced, for the 1949-50 season, the former Permatang Pauh Padi Station.

102. *Kedah*.—Gajah Mati Agricultural Station and Telok Chengai Padi Experiment Station were maintained from Federal funds and the five Padi Test Stations at Jitra, Kangar, Sala Kanan, Pulau and Rantau Panjang from State funds.

103. Gajah Mati has 112 acres developed of a total of 279 acres, and is the largest dry-land Station operated by the Department, apart from the Federal Experiment Station, Serdang. Investigations in hand during the year included trials of the effects of various types of shade and planting distances on cocoa, of fertilisers on groundnuts and of hormone weed-killers in eradicating *Mimosa pudica*, a persistent weed in pasturages.

104. At Telok Chengai, the work undertaken was along similar lines to that of the previous season and comprised the selection of high yielding strains of padi, together with manurial, cultivation and variety trials. The varieties used as foundation stock in selection were Radin Ebos, Lembut Pandan, Anak Didek, Haji Harun, Radin Goi and Mayang Pasir; while progeny rows were maintained of eighteen long-standing selections. The manurial experiments comprised a continuation of a long-term bat guano trial and two new experiments with North African "hyperphosphate". The cultivation experiment to determine the optimum age at which seedlings should be transplanted was continued. In the variety trials, the relative merits of 18 varieties, imported from Burma, are being assessed.

105. At the Padi Test Stations, the planned 3-year programme of variety trials was continued. Two additional Stations, at Kulim and Pulau Langkawi, were utilised during the year for varietal work.

106. *Kelantan*.—Kota Bharu and Melor Padi Experiment Stations were maintained from Federal funds and the Padi Test Stations at Pasir Mas, Bachok and Pasir Puteh from State funds. The Melor Station is for work on dry padi and all the remaining Stations, with the exception of Pasir Puteh, have areas for work on dry-land crops as well as padi.

107. The work on wet padi at Kota Bharu included the living herbarium of medium term varieties which was commenced in 1947, further trials with rock phosphate, "hyperphosphate" and mono-ammonium phosphate and a considerable programme of mechanisation experiments. These latter included the standard experiments on depths and times of cultivation and on depths of cultivation and off-season cropping together with tests on a number of horticultural machines and their associated implements. Two new mechanisation experiments were laid down, one to compare rotary cultivation with ploughing and methods of after-cultivation as variants and the other to compare cultivation under wet and dry conditions. Other investigational work of more local significance included the grafting of tomatoes on other solanaceous root stocks, the spraying of tomato plants with fruit-setting hormones and trials with imported varieties of cabbage.

108. At Melor, for the third successive year, sixteen varieties of dry padi were studied, in a randomised block layout, fertiliser placement experiments were begun and the 1948 programme of mechanisation experiments was repeated. At this Station, deep cultivation has resulted in considerably increased yields. In addition to the work on dry padi, variety trials were conducted with dwarf cowpeas, groundnuts and sweet potatoes together with observations on the growing of sunflowers.

109. The Pasir Mas and Pasir Puteh Stations carried out trials of short and medium term varieties of padi, the latter also being carried out at Bachok. The Kota Bharu living herbarium of medium term varieties was duplicated at Pasir Mas. Trials of rock melon varieties and of various strains of soya bean were carried out at Bachok.

110. Mechanisation trials were carried out in the Kelantan plain in a number of areas on smallholders' land, as a supplement to the work in progress at Kota Bharu and Melor Stations.

111. *Penang and Province Wellesley*.—Ayer Itam Agricultural Station and Bukit Merah Padi Experiment Station were maintained from Federal funds and Bukit Mertajam Agricultural Station, together with the Sungei Acheh and Ginting Padi Test Stations, from Settlement funds.

112. At Ayer Itam, the standard cocoa experiment on similar lines to that at Gajah Mati, Kedah, was laid down and other investigations comprised further trials with sweet potato varieties and an experiment on fertiliser applications and cutting frequencies in respect of certain fodder grasses.

113. Bukit Merah Padi Experiment Station carried a heavy programme of experiments, including double and triple cropping annually with padi; the off-season cropping of padi land with vegetables, manurial experiments with bat guano and "hyperphosphate", cultivation experiments on the age of seedlings for transplanting and the disposal of straw respectively, together

with a number of experiments on mechanised cultivation embracing depth, time and different degrees of cultivation. Numerous observations were also carried out on different combinations of machines.

114. A considerable amount of mechanised cultivation was also carried out co-operatively on smallholders' land, in extension of the work at Bukit Merah.

115. The Padi Test Stations at Sungei Acheh and Ginting carried trials of varieties suitable for planting in the padi areas of the Settlement.

116. *Perak*.—Degong Agricultural Station and the Padi Experiment Stations at Titi Serong and Chenderong Balai were maintained from Federal funds and Selama, Kuala Kangsar, Ayer Tawar and Simpang Tiga Agricultural Stations, Sungei Manik and Talang Padi Experiment Stations and the Padi Test Stations at Kuala Kurau, Tanjong Piandang, Briah, Bagan Serai, Selinsing, and Bruas from State funds.

117. Degong Agricultural Station carried clonal fruit tree variety trials, while the standard cocoa experiment was in process of being laid down.

118. At Titi Serong Padi Experiment Station, selection work on the Seraup variety continued together with observations on a number of other long-term varieties.

119. Chenderong Balai is the Station for mechanisation trials on peat soils. The work is proving far from easy owing to the difficulties of water control and the presence of stumps and underground timbers which cannot be disposed of, by known methods, without an expenditure both of time and money, which seems scarcely economic or indeed likely to be practicable.

120. At Talang, Sungei Manik and the various Padi Test Stations, a series of variety trials and fertiliser experiments were carried out.

121. *Selangor*.—The Federal Experiment Station, Port Swettenham, is maintained from Federal funds, and Cheras and Telok Datoh Agricultural Stations and the Padi Test Stations at Panchang Bedina and Tanjong Karang from State funds. An additional Agricultural Station is in course of being opened up at Sungei Burong, to be maintained from State funds.

122. Port Swettenham has, since 1948, been developed, as the Experiment Station to represent coastal clay soils, in addition to its former function as the Station for work on coconuts. The coconut selection work was continued but the blocks concerned had superimposed on them experiments to test the effect of various methods of mechanical inter-row cultivation, cover cropping and methods of drainage. These main treatments were again sub-divided into sub-plots to test the comparative effects of controlling the grass or cover crop growth by (a) grazing, (b) cutting and (c) harrowing. The standard cocoa experiment to test shades and spacing was also laid down together with two experiments to test whether cocoa can be interplanted with rubber grown on the hedge system. In these latter experiments, two other treatments with controls were applied (a) chiselling and (b) drains isolating the rubber from the cocoa to prevent

root competition. Experiments in course of being laid down were (a) tests of the drainage requirements of rubber, cocoa and oil palm on coastal clays and (b) a Manila hemp trial combining varieties with cultivation and drainage treatments.

123. Egg-laying trials to compare the respective merits of Rhode Island Red and Australorp poultry breeds continued at Cheras and Telok Datoh Agricultural Stations.

124. At the Padi Stations, ear-to-row selection of the local varieties Acheh and Serayap continued together with a planned series of trials of other varieties.

125. *Trengganu*.—With the post of State Agricultural Officer vacant since 1947, owing to shortage of staff, little or no investigation work has been carried out as yet in Trengganu. During the year, steps were taken to reserve two blocks each of 100 acres in the Jerangau area on good granite soils, largely for the purpose of experimental work on cocoa on these soil types.

126. *Pahang*.—Temerloh Agricultural Station and Paya Besar Padi Test Station were maintained from Federal funds and Kuala Lipis, Raub, Kuantan and Pekan Agricultural Stations together with the Padi Test Stations at Dong, Mengkarak, Temerloh, Kerdau, Bawang and Pahang Tua from State funds.

127. Temerloh Agricultural Station in the past carried out pioneer work on cocoa and Manila hemp and still remains an important centre for the distribution of planting material of these crops. The standard cocoa experiment was laid down there during the year. Cultivation and manurial experiments were continued at Paya Besar Padi Test Station.

128. Trials, both variety and manurial, with cocoa, coffee, pepper and fodder grasses were being laid down at either Raub, Kuala Lipis or Pekan Agricultural Stations. At the remaining Padi Test Stations, variety trials and cultivation and manurial experiments were continued. An interesting feature of the work in Pahang is the search for a variety of padi capable of being grown and harvested before the commencement of the flood season in the river mukims.

129. *Cameron Highlands*.—At the Tanah Rata Agricultural Station, tea strain selection work commenced and two fertiliser experiments on tea were laid down. A total of 41 experiments on vegetables was laid down, of which 28 had been completed at the close of the year. The great majority were variety trials embracing both local (standard) and imported types. Trials with fertilisers and insecticides were also laid down. The progeny testing experiment with poultry of the Rhode Island breed was completed and further trials planned.

130. *Negri Sembilan*.—Rembau Agricultural Station and Kendong Padi Test Station were maintained from Federal funds and the Padi Test Stations at Kuala Pilah and Jelebu from State funds.

131. The standard cocoa trial was laid down at Rembau Agricultural Station and an experiment to compare the behaviour of pure-bred and local fowls under both Agricultural Station and kampong conditions of management and feeding was in course

of being laid down at the end of the year, likewise a manurial trial on clonal fruit. At Kendong Padi Test Station, selection of the variety, Serendah Kuning, was continued together with a programme of variety trials.

132. At the remaining Padi Test Stations, the programme of variety trials was continued.

133. *Malacca*.—Sungei Udang Agricultural Station and Pulau Gadong Padi Experiment Station were maintained from Federal funds and the Padi Test Stations at Jasin and Alor Gajah from Settlement funds.

134. Variety trials of sweet potato and soya bean were carried out at Sungei Udang Agricultural Station together with observations on the crossing of British Alpine and local breeds of goats.

135. The work at Pulau Gadong Padi Experiment Station comprised selection of the varieties Nachin and Siam, field trials of improved strains suitable for planting in the Settlement, manurial experiments with calcined bones and "hyperphosphate", including placement trials, together with mechanisation cultivation experiments. These latter included the standard depth and time of ploughing trial, plus the cultivation of off-season crops, and cultivation under both wet and dry conditions.

136. At the Settlement Padi Test Stations, Alor Gajah and Jasin, the programme of variety trials was continued.

137. *Johore*.—Ayer Hitam Agricultural Station, the Pineapple Experiment Station, Pontian, and Endau Padi Test Station were maintained from Federal funds and Tangkak Agricultural Station, Ulu Tiram Agricultural Station, and the Padi Test Stations at Jementah, Kahang and Tenglu from State funds.

138. At Ayer Hitam Agricultural Station, the standard experiment on cocoa was laid down; likewise at Tangkak Agricultural Station.

139. Development of the Pineapple Experiment Station was held up for the second year in succession, on account of banditry. A comprehensive programme of agronomic and botanical investigations has been drawn up for this Station, which will be put into effect as soon as conditions permit.

140. The programme of variety trials was continued at all Padi Test Stations.

(ii) DETAILS OF RESEARCH AND INVESTIGATION.

141. A more detailed account of both fundamental research and agronomic investigations is presented below under crop heads.

142. This is thought to make for a more logical and readable presentation than a classification on a basis of work done by Branches or Divisions of Branches as has been done in previous Reports.

1.—PADI.

(A).—*Wet Padi.*

(i) BREEDING AND SELECTION.

143. (a) *Introduction*.—The programme of the systematic Malayan-wide variety survey and variety selection, formulated in 1947, with minor modifications and reverses, made effective progress during 1949, and already shows prospect of success.

144. Efficiency and progress have been handicapped by the shortage of trained and experienced subordinate staff, staffing transfer difficulties and lack of adequate laboratory accommodation at some of the major Padi Experiment Stations.

145. (b) *Variety Survey*.—A progressive survey of all Malayan varieties of padi is being made with an increasing collection of varieties grown in observation lines at convenient Padi Experiment Stations. Detailed observations and measurements of characters, and records of behaviour are made each season.

146. At Kota Bharu and Pasir Mas Padi Experiment Stations in Kelantan there are now 365 lines of east coast varieties; at Pulau Gadong Padi Experiment Station, Malacca, 396 medium and short-term west coast and Pahang varieties; and at Titi Serong Padi Experiment Station, Krian, 140 long-term varieties from all the padi areas concerned in Malaya.

147. (c) *Variety Classification*.—Contemporarily and in conjunction with the variety survey, additions are being made to the dry herbarium collection of specimen ears for record and reference, particularly with reference to a variety grouping and classification, which, eventually, would be of especial value in facilitating the design of a programme of breeding, and other long-term aspects of padi improvement work. The classification of varieties is based chiefly on grain characters. A further 308 specimens were added to the herbarium during 1949, and it now contains 1,070 sheets of specimens of 606 apparently distinct Malayan varieties of padi. A variety collection of specimen-tube samples of grain is also being accumulated; a total of 353 samples were added during the year.

148. (d) *Variety Trials*.—Comparative trials of established and recommended varieties are being made at 37 Padi Stations and Test Plots, in all States and Settlements of the Federation. The present series of variety trials have been designed largely to correlate their results with those of pre-war variety trials and to obtain as much information from these as possible before adopting a more standardised series. They are intended to remain unaltered as regards variety composition for three years, and will be revised at the end of the 1949-1950 season. Harvesting and measuring the crops in these trials continues from December to March in any year and results are then analysed. The analyses of the 1948-1949 season crop were completed in August, and, in general, confirmed those of the 1947-1948 season, but in some cases reversal of relative variety behaviour has occurred. Because analysis of such a considerable amount of data takes a long time, a provisional revision of the composition of these trials is now being made in anticipation of the need for early decisions in 1950, in advance of the 1950-1951 season.

149. (e) *Variety Selection*.—Intra-variety selection for isolation of strains with maximum yield and straw strength was continued on the varieties, Serendah Kuning at Kendong and other Padi Stations in Negri Sembilan; Nachin at Pulau Gadong Padi Experiment Station, Malacca; Radin Ebos at Telok Chengai Padi Experiment Station, Kedah and Mayang Sa Batil at Genting Padi Experiment Station, Penang.

150. The selection stock of the varieties, Serendah Kuning and Nachin, has been reduced to 50 to 60 lines of each variety by elimination of inferior types during the past two years. These lines will be maintained without further reduction for positive selection of the best types at the end of another three years. Yields from the 1948-1949 crop were about 50 per cent. higher at Kendong, Negri Sembilan, 16 per cent. higher at Pulau Gadong, Malacca, but slightly lower at Ampang Tinggi, Negri Sembilan, than in 1948.

151. Selection of Mayang Sa Batil and Radin Ebos varieties is in its second year and stocks have been reduced by about 50 per cent. It is proposed to continue elimination of inferior material from these stocks for a third year before positive selection is commenced. This has been found desirable owing to variability in yield of individual lines from season to season.

152. Mass selection is being simultaneously carried out in these four varieties and is now being based on yield measurements of individual plants instead of, as hitherto, only on appearance.

153. New ear-row selection work was commenced in the 1948-1949 season on the varieties Seraup at Titi Serong, Perak, and Siam at Pulau Gadong, Malacca, commencing, in each case, with a foundation stock of 1,000 lines derived from a composite planting of widespread collection. Ear-row selection has also commenced on the medium-short-term varieties, Acheh Puteh and Serayap at two stations in Selangor.

154. (f) *Breeding*.—Experiments aimed at the determination of the degree of natural crossing are being continued. The plots are not yet mature but the occurrence of hybrids has been noted. Indications are that the frequency of outcrossing is unlikely to be sufficient to impair selection work seriously. Some of the material originally used has proved to be heterozygous and this work should therefore be repeated as soon as inbred lines are available.

155. (g) *Variety Introductions*.—Of 18 Burmese varieties introduced for trial, only 2 or 3 show promise of growing satisfactorily under Malayan conditions. All 18 varieties were replanted this year but were severely damaged by rain while flowering. The more promising will be tried again next season.

156. Ten reputedly salt tolerant varieties from Ceylon were grown at Tanjong Piandang in Perak, but were damaged by rats. These will be regrown in two areas next season.

157. Four introductions from Siam were planted at Telok Chengai, Kedah; one of these, Kao Pudart, shows promise.

158. (h) *Export of Malayan Varieties*.—Seed samples of typical Malayan varieties have been sent to Italy, Uganda, Sierra Leone, Portugal and Argentina for trial. Reports from Venezuela on varieties sent there last year indicate that maturation periods are appreciably less there than in Malaya; growth of these varieties was satisfactory but yield data are not available.

(ii) SOWING TRIAL.

159. A series of experiments initiated at the Federal Experiment Station, Serdang, and later extended to Kelantan, Province Wellesley and Malacca, has shown that a satisfactory stand of padi may be obtained by broadcasting seed, and that the best results are likely to be obtained when seed is soaked and germinated before sowing and then dropped in shallow water, which should be clear and not muddy, some 2 inches deep.

(iii) PADI IN RELATION TO SOILS.

160. (a) *Soil Investigations and Surveys in Existing Padi Areas*.—In order to investigate further the causes underlying the poor returns of some padi areas, soil sampling of certain areas was undertaken. In co-operation with the State and Settlement Agricultural Officers concerned, several *sawahs** in Penang, Province Wellesley, Kedah and Perak, were chosen on the basis that they were known to give consistently high or low yields which could be attributed to soil conditions.

161. In order to make certain that the samples were representative of the *sawahs* concerned, a tube sampler was constructed, thus enabling a large number of samples to be taken quickly. By providing a movable ring on the outside, it was possible to take samples to a predetermined depth even when the soils were under water. Two samples were taken from each bulked sample for laboratory examination and the analyses showed that good uniformity had been reached in the taking of the samples.

162. Mechanical and chemical analyses were carried out on the samples, the latter including chlorides, sulphates and arsenic. Mechanical analyses showed that while the highest yields are obtained from the heavy clays and heavy silty clays, good yields are also being obtained on some sandy soils. On the other hand, some of the soils from the poor yielding areas had a high clay and silt content.

163. Determination of "total" CaO and P_2O_5 by extraction with hydrochloric acid showed that while there were wide variations in the values obtained there appeared to be no correlation between the amount in the soil as determined by the method and the yields obtained.

164. Determination of the "available" K_2O and P_2O_5 by the Neubauer method (*vide* para. 412) was also carried out. It was found that the growth of the padi seedlings corresponded closely with the rating on a field scale. The seedlings growing on the soil from the good areas showed better and sturdier growth. There were a few exceptions, however, where the seedlings on an alleged poor soil gave good growth, and in these cases the poor yields normally obtained may be due to external factors.

* An irrigated padi field.

165. (b) *Soils Surveys of New Padi Areas*.—Following reconnaissance soil surveys in the Trans-Perak area in 1948, it was decided that, in order to get an adequate knowledge of the soils in this large area, systematic soil sampling would have to be undertaken. Consequently, soil sampling on a grid basis was started and is being carried out by Agricultural Assistants under the direction of the State Agricultural Officer, Perak. During the period under review, 340 samples were analysed. The survey has shown that a large proportion of the Raja Hitam Forest Reserve consists of clay soils and that very little peat is present in the area. Other samples, taken on the west bank of the river, showed that a mixture of peat and clay exists and, in some cases, a layer of silt was found to cover the peat.

166. A large number of soil samples was received from the Sungei Balang area in Johore and in general those soils were found to consist of good padi clays.

(c) POT EXPERIMENTS.

167. (i) *Padi in Peat*.—Since many of the new areas to be developed for padi cultivation are situated on peat, it was decided to set up a pot experiment to try out various manurial treatments. For this purpose a quantity of peat from Jalan Kebun in the Telok Forest Reserve, Selangor, was obtained. The material was the "spoil" from a drain which had been dug to a depth of 2 feet. With this material, six rows containing 12 pots per row were set up and irrigated by the cascade system from tanks situated at the top of the rows. Each pot contained 32 kilos. of peat.

168. Six main treatments were under trial namely, control, nitrogen, phosphate, potash, N.P.K. and finally a triple dressing of potash. In addition, one pot in each row was treated with zinc sulphate, one with copper sulphate and one with manganese sulphate. The manures were applied at the following rates:

Sulphate of ammonia at the rate of 2 cwts. per acre.

Rock phosphate at the rate of 4 cwts. per acre.

Muriate of potash at the rate of 2 cwts. per acre.

N.P.K. dressing at the rate of 8 cwts. per acre.

The copper sulphate was applied at the rate of 75 lbs. per acre and the zinc and manganese sulphate at 25 lbs. per acre.

169. Seedlings of the variety Radin Siak, three per pot, were planted out five days after the application of the fertilisers. Within a short time of transplanting, differences were obvious between the various treatments. The plants in the nitrogen-treated pots showed the best growth and development, followed by the phosphate and potash and finally the control. The striking increase in the vegetative growth of the nitrogen-treated plants was surprising in view of the fact that the peat had a high nitrogen content. This response has been confirmed in experiments on oligotrophic peats elsewhere and was also borne out by the yields obtained from these pots.

170. The first plants to reach maturity were those in the pots which had received a dressing of N.P.K., closely followed by the nitrogen, potash, triple potash and rock phosphate treated pots. The control was considerably later in maturing. No benefit resulted from the dressings of trace elements, in fact, in several cases, they had a depressing effect on growth.

171. The mean yield of grain per pot from the various treatments is shown below:

Treatment.	Mean yield of grain per pot. grms.	Mean height at 2 months. ins.	No. of tillers per pot set at maturity.
Control	34.5	19.2	9
Nitrogen	53.4	35.4	15
Phosphate	40.5	31.8	16
Potash	37.2	33.8	13
N.P.K.	58.4	38.1	24
Triple Potash	40.8	31.2	15

It will be seen from this table that all the manurial treatments have given an increase over the control. The best yield from any individual treatment was obtained from the nitrogen dressing while the N.P.K. treatment showed its superiority over all the others.

172. These results show that in certain circumstances the addition of artificial fertilisers, especially nitrogen, to peat gives a good response and that the growth of the padi without fertilisers is poor. To translate these results into field practice will need trials on various areas, as the peat from one place to another shows some variation and the depth of peat also has a considerable influence on the growth of the crop.

173. (ii) *Trace Elements*.—Past experience with manurial trials on padi has led to the conclusion that there is a "bar" over which yields cannot be economically increased. It has been suggested that there may be some deficiency in one or other of the trace elements. Accordingly, a pot experiment, using a reasonably good padi soil, was commenced. The trace elements tried were arsenic, boron, copper, tungsten, vanadium, molybdenum and zinc. Several combinations of these elements were also applied and, in addition, all seven plus a dressing of N.P.K. The treatments were applied, if in soluble form, in solution, or mixed with dried soil before application. The seedlings, five weeks old, were planted out two days after the application of the trace elements. Considerable trouble was experienced in this, as in previous experiments, in controlling stem borers, even though dusting with D.D.T. was carried out.

174. During growth the treated plants showed no benefit over the control, and, in the case of the vanadium and molybdenum treated pots, the growth of the plants was depressed and they had a stunted and yellow appearance.

175. This failure of the treated plants to benefit was also shown in the yield records, for none of the treatment yields showed any significant increase over the controls, while the vanadium and molybdenum treatments gave considerably poorer returns.

(iv) FIELD MANURIAL EXPERIMENTS.

176. Experiments continued to test the value of the padi growers' common practices of applying bat guano to the crop in the field, and dipping seedlings into various types of slurries before planting. Further, three new series of experiments were started to compare North African rock phosphate with that of Christmas Island and to determine the effects of times of application and methods of placement. Preliminary investigations conducted in Kelantan in connection with placement of manures are giving promising results and will be developed.

(v) HORMONE WEEDKILLER EXPERIMENTS.

177. Investigations conducted in Province Wellesley on the use of hormone weedkillers have shown promise and will be continued.

(B).—DRY PADI.

(i) BREEDING AND SELECTION.

178. The variety trial of 16 varieties was continued at Melor Agricultural Station, Kelantan. Yields were, overall, somewhat better than in the previous season, Muar Pergau giving the highest yield of 806 lbs. clean dry padi per acre, which was, however, not significantly better than the highest yielding variety of the previous season, Muar Pa Dok. This variety gave 779 lbs. per acre this season. Both Mayang Ambor and Jintan Manis which did relatively well in 1948, were low on the list this season, yielding 402 and 411 lbs. respectively. The trial is therefore being continued into a third season.

179. The two strains of dry padi introduced from Borneo, though late planted, did sufficiently well to warrant inclusion in future variety trials.

(C).—PADI CULTIVATION EXPERIMENTS.

(i) MECHANISED CULTIVATION.

180. (a) *Wet Padi*.—A mission, including Dr. E. W. Russell of Oxford University and Mr. J. C. Hawkins of the National Institute of Agricultural Engineering, visited Malaya in July and August. This mission was sent out by the Secretary of State for the Colonies to review the Department's mechanisation work and to make recommendations for future lines of work. (See also Section IV—E, para. 547 of this Report). The Report of the mission is awaited.

181. Investigations in padi mechanisation have so far been conducted mainly in two soil types: (i) on peat soils which have not yet been colonised and which are typical of several of the larger Drainage and Irrigation Department schemes intended for padi-growing development, and (ii) on clays and loams with a firm bottom on which there exists a settled padi-growing population but for which there exists, on present knowledge, no large areas available for future settlement on a padi-growing basis.

182. (i) *Peat Soils*.—The work accomplished at Chenderong Balai, Perak, may be summarised as follows:

- (a) It has been shown that the main obstacle to the mechanisation of padi-growing on deep, peat soils is the existence of stumps and underground timbers.
- (b) It has been shown that the next obstacle of importance is the lack of well controlled drainage.
- (c) It has been found that wheeled-tractors are normally unsatisfactory and that standard track-tractors may be modified by an increase in track width to be capable of hauling the necessary implements.
- (d) Disc-harrows and disc-ploughs have proved to be capable of producing a satisfactory seed bed, and standard seed drills, only slightly modified by an increase in their wheel width, are capable of drilling seed satisfactorily.

It is considered that little will be gained by further mechanisation investigations on cultivation in these soils, until the obstacles mentioned under (a) and (b) above have been overcome. This is likely to be expensive and the investigational programme now being conducted has as its object the determination of the engineering commitments required to clear timbers and control drainage; for example, a survey is being conducted to determine the number of stumps and amount of submerged timber per acre, and tests are being made with a dynamometer to ascertain the pulls required to remove them.

183. (ii) *Clays and Loams*.—Investigations have been conducted on Padi Experiment Stations in Kelantan (Kota Bharu), Province Wellesley (Bukit Merah), and Malacca (Pulau Gadong), and on smallholders' land of varying clay/loam compositions in Kelantan and Province Wellesley. These soils have firm bottoms as opposed to the "bottomless" deep coastal alluvial clays where, of course, mechanisation is impracticable. The investigations included both experiments with replicated lay-outs, and trials, both engineering and agronomic, in non-replicated blocks. Considerable experience has been gained in the mechanical cultivation of small areas such as is necessary in replicated experiments and in the small plots surrounded by bunds, which are typical of any area carrying a dense population.

184. In the 1947-48 and 1948-49 seasons the power unit, in most cases, was the standard Fordson which is a comparatively heavy tractor for its power. The Ferguson and the Ransome M.G.2 tractors which have been tested more recently are lighter although of less power and they have made the engineering problems considerably easier. With the Fordson, attempts were made to overcome the heavy weight of the tractor by increasing the width of the wheels but this also increased rolling resistance and decreased the power available for useful work. The mission referred to in para. 180 above recommended that more use should be made of standard wheels both steel and pneumatic and this was done, especially in Kelantan, where satisfactory cultivations were performed with the Fordson on pneumatic tyres and Rotavator attachment and with the Ferguson with its associated ploughs, on both pneumatic tyres and standard steel wheels.

185. Investigations were conducted to ascertain the efficiency of various methods of cultivation, such as rotary cultivation versus deep and shallow ploughing, and the effect of cultivations at various times.

186. (b) *Dry Padi*.—A series of experiments similar to those performed on wet padi was conducted at Melor Agricultural Station, Kelantan. In general, dry padi reacted to a greater extent than wet padi to deeper cultivations. Indeed deep ploughing gave an increased yield of 50 per cent. over the standard practice.

(ii) NON-MECHANISED CULTIVATION OF WET PADI.

187. A series of experiments was started at four Padi Stations in Pahang in 1947 and 1948 to compare ploughing and harrowing with buffaloes against hoeing by *changkol*, slashing by *tajak*, and puddling by means of buffaloes (*melanyak*). This series of experiments is designed to run for some five years.

(iii) OFF-SEASON PADI CULTIVATION.

188. Trials with off-season padi cropping are being conducted in Province Wellesley and Malacca and, in the former, it has been found that in certain circumstances an off-season crop of Taiwan padi may be obtained without any significant decrease in yield of the main crop.

(D).—PADI DISEASES.

(i) BLAST (*pyricularia oryzae*).

189. No serious attack on a large scale by this fungus occurred during the year. In most of the reported cases the disease had caused leaf-spotting of seedlings in the nursery and after planting out the disease disappeared and did not recur. Only one case of attack on mature plants was reported and one on plants 3½ months old, both in Johore, and the areas affected were small. The disease was found in new localities in Negri Sembilan, Selangor, Johore and Perak and it is now obvious that *P. oryzae* is very widely distributed; it has been recorded from all States and Settlements except Trengganu and Perlis.

190. Trials were carried out to discover whether control of blast could be obtained in the nursery by spraying. Spraying was carried out on dry nurseries at intervals of four days. All the sprays tested, viz., Bordeaux mixture, Perenox, Spersul, Shell Copper Fungicide and Shell Copper Fungicide with white oil gave partial control of the disease in trials carried out at the Research Laboratories, Kuala Lumpur.

191. Species of *Pyricularia* morphologically similar to that causing blast of rice have now been observed causing leaf spots on five hosts other than rice. These included three previously recorded hosts, namely *Eleusine coracana* (ragi), *E. indica* and *Digitaria sanguinalis* and two new records, viz., *Oryza minuta* and *Bracharia mutica* (Para grass).

(ii) SCLEROTIAL DISEASES.

192. Two sclerotial fungi which commonly attack padi in Malaya are *Rhizoctonia solani* (*Corticium solani*) and *Sclerotium oryzae* (*Leptosphaeria salvinii*).

193. *Rhizoctonia solani* is the commoner and more widespread, and this year was specially noticeable in Negri Sembilan and Johore. Records have also been made in Kelantan and Selangor. This fungus causes the death of the outer leaves and, in severe cases, of whole tillers. The fungus attacks the leaf sheaths, on which large, rotten, pale-green or bleached areas are formed. As these enlarge, the attacked leaf dries out and dies from the tip. Occasionally, spots similar to those on the sheath are formed on the blade of the leaf. Seedlings in the nursery may also be attacked by *R. solani*, patches of them being killed. This occurs especially in damp conditions and where closely planted seedlings are making quick, soft growth.

194. *Sclerotium oryzae* occurs chiefly in Kedah. As in the case of *R. solani*, leaves and tillers are killed. The fungus attacks the base of the tillers, which are rotted and become black. Sclerotia are formed in the tissues of the leaf sheaths and also between the sheaths but rarely on the outer surface.

(iii) PENYAKIT MERAH.

195. The disease locally known as *penyakit merah* (red sickness), symptoms of which are a dark purple or rusty red discolouration of the leaves accompanied by stunting, cessation of growth and sometimes death of the plants, was recorded from several widely separated localities. The disease appears to be non-parasitic in origin, no fungus or other organism having been found associated with it: tests carried out by the State Agricultural Officer, Kelantan, suggest that the condition is brought about by some unfavourable soil factor. Certainly, plants showing the symptoms of *penyakit merah* have, on being transferred to pots of soil in Kuala Lumpur, recovered, young leaves subsequently produced showing no discolouration.

(iv) OTHER DISEASES.

196. Other commonly occurring diseases were the leaf spots caused by *Helminthosporium oryzae* (*Ophiobolus miyabeanus*) most commonly found on seedlings and often causing serious damage in nurseries, and *Cercospora oryzae* which only attacks plants when they are approaching maturity.

(E).—PADI INSECT PESTS.

(i) STEM-BORERS.

197. The Latin square insecticidal tests at Sungei Burong, Tanjong Karang, Selangor (referred to in last year's report) failed to give satisfactory control of the internal stem-boring caterpillars. Three nursery dustings had been applied at weekly intervals during September and October, 1948, and counts of bored tillers made in the field in the following April were very low in intensity. The percentages of observed damaged tillers were: Agroicide 3-2.8; chlorinated camphene (Toxaphene)—2.6; 5 per cent. DDT—2.2; and untreated control—3.3. Examination, by splitting of the stems of complete plants carried back to the laboratory, and analysis of plot yields after harvesting both confirmed that there was no significant difference between dusted and undusted plots.

198. Further tests were made on padi nurseries at the College of Agriculture, Serdang, where four weekly dustings in June and July with 5 per cent. DDT, Agroicide 3 and chlorinated camphene were carried out. Results are not yet available.

199. Realising that nursery dustings offered a less likely method of dealing with these borers than the newer liquid insecticides now available, spraying tests were made in September with E. 605 (Thiophos 3422 or Parathion) and also with T.E.P.P. (tetra-ethyl-pyrophosphate) at the rate of 0.6 part per 1,000 applied at the rate of 60 gallons per acre and 1 part per 1,000 at 100 gallons per acre to small plots. Results are not yet to hand.

200. A laboratory test with bored plants collected in the field, sprayed with E. 605 at 1 part per 1,000, planted in pots and examined one week later gave a 57 per cent. mortality of the borers extracted from split stems. Owing to decomposition of the bodies of the caterpillars in the stems, it was impossible to ascertain which species were involved. A similar test with

T.E.P.P. at 1 part per 500 gave a 29 per cent. mortality of borers, mostly *Schoenobius incertellus* (Walk.). When this was repeated with T.E.P.P. (1 part per 1,000) and the plants examined after two weeks, a mortality of 76 per cent. was obtained.

201. A final field test was made in December which will not give results until about April, 1950. In a nursery spraying, carried out only once immediately before transplanting, the following insecticides were used: Wettable Agrocide at 4 grms. per litre, "Fosferno 20" (E. 605) at 1 cc. per litre and "Thiopel" (E. 605) at 1 cc. per 4 litres. As a modification, some plants had their roots placed in solutions of the last two systemic insecticides for 24 hrs. and were then planted out. In both of these cases, care will have to be taken to ensure that the absorption by the plant of the insecticides does not persist in dangerous amounts at harvest. No other method of chemical control of these borers holds much promise.

202. From an examination of bored tillers sent from Padi Experiment Stations, mostly in Malacca and Negri Sembilan, it was found that *Schoenobius incertellus* (Walk.) was the most abundant borer followed, in this order, by *Sesamia inferens* (Walk.), *Proceras polychrysus* (Meyr.) and *Chilo suppressalis* (Walk.). It is necessary to point out, however, that damage by *Schoenobius* is most readily seen in the field and this species tends therefore to be best represented in samples of bored tillers collected.

203. Through the courtesy of the Director of the Commonwealth Institute of Entomology, London, it was shown that the borer referred to for many years as *Diatraea polychrysa* Meyr. should really be *Proceras polychrysus* (Meyr.), the former genus being restricted to tropical and sub-tropical America.

204. From a collection of pupae of all the above insects, except *Chilo*, an Eulophid parasite was reared which probably parasitised the larvae. It was identified in Washington as a species of *Cirrospilus* near *ingenus* Gahan. It is, unfortunately, of negligible importance in controlling stem-borers in the field.

(ii) PIANGGANG.

205. Large numbers of the Coreid *Leptocorisa acuta* Thunb. occurred near Kuala Linggi, Malacca, and bagging tests on padi plants, with an average of only two bugs per ear, gave 98 per cent. of "empty" grains, white in colour. Similar muslin bags placed around the ears prior to emergence from the leaf-sheath had only 26 per cent. "empty" grains. Further studies of this insect are under way with a view to its control.

(iii) LEAF-HOPPERS.

206. Reports of an orange-red condition of the leaves referred to as *penyakit merah* was associated with the Delphacid *Sogata furcifera* (Horv.) in Pahang and the Jassid *Nephotettix bipunctatus* F. were received from Penang and Lower Perak. Application of DDT at 20 lbs. per acre to the affected area in Penang, gave a good reduction in numbers of the leaf-hoppers with a return of normal colour to the plants.

(iv) PADI MIDGE.

207. Some plots at the Federal Experiment Station, Serdang, concerned with experimentation in broadcasting padi seed, showed damage consisting of cutting of the base of the leaves, which floated to the surface. Some small, pink, boring larvae about 1 mm. long were found inside the stems and from them one Chironomid midge was reared which had not been found before in Malaya. It appears to be closely related to *Chironomus orzaze* Mats. recorded from a similar source in Japanese rice fields. No proof was obtained that the larvae actually cut the leaf-bases.

2.—RUBBER.

(i) RUBBER SEED OIL INVESTIGATIONS.

208. In continuation of the experiments with rubber seed to answer certain technical questions affecting the practical possibilities of manufacturing rubber seed oil, the seeds from the drying experiments which commenced during the main harvest in October and November, 1948, were stored for examination at bi-monthly intervals throughout 1949. The objects of this investigation were to determine (a) how frequently seeds must be collected (b) the best methods of drying and (c) the keeping quality of the dried seeds.

209. The results of these experiments had already indicated that in dry weather really fresh seeds would keep in good condition on the ground for at least two weeks and that collections at shorter intervals than this were therefore not necessary. Once an area is cleared of all old seeds, a weekly collection will generally suffice if thoroughly carried out, a fact which is very important from the financial aspect, as the cost of collection of seeds represents by far the biggest item in the production cost. The results also showed that an efficient and economical method would be to dry seeds in the existing smoke-houses on estates. These smoke-houses are usually maintained at a temperature of 60°C. Seeds so dried were found to keep in good condition for about 6 months, but normally, it would not be necessary to store seeds for such a long period before processing. If, however, the seeds were first heated to 100°C for 1 hour to destroy the lipase, and the moisture content then reduced to about 6 per cent., they would keep in good condition for over one year. Although some of the kernels would develop mould, the f.f.a. of the oil would still be under 3 per cent., calculated as oleic acid.

210. Experiments were also carried out on the pressing of rubber seeds and the determination of the keeping quality of the oil. One portion of oil from each sample was kept without further treatment and the remaining portion heated to 100°C for a few minutes before storage. The results indicate that, providing the initial acidity of the oil is low, the increase in acidity on storage is small and sterilisation is not necessary.

3.—OIL PALM.

(i) BREEDING AND SELECTION.

211. (a) "*Deli*" Palms.—Routine collection and recording of data for selection of oil palms was continued at the Federal Experiment Station, Serdang; yield of fruit bunches and measurements of fruit characters being recorded, weekly, for individual palms.

212. Statistical analyses of yield and fruit character records were made to study the degree of variation in such characters between families and within families, with the object of improving selection techniques.

213. It is apparent, for instance, that the "selfed" families—E. 268 and E. 211—have been significantly the highest yielders of fruit bunches. Family E. 152 has shown a very wide range of segregation. Family E. 93 has given a significantly higher mean per cent. pericarp on fruit. Statistical analyses have also shown that measurements from five samples of fruit per palm will give an adequate estimate of percentage pericarp on fruit, while five measurements do not give a reliable estimation of percentage clean fruit per bunch.

214. It is of particular interest that the "dumpy" family E. 206, selfed, has shown uniformity of growth of "dumpy" habit, but, at present doubt exists as to whether this family has bred true for a pure recessive genetical character of "dumpiness", or whether this "character" is an extreme expression of quantitative genetical factors for height and girth.

215. The two dumpy $\times$ tall crossed families, 206 $\times$ 268 and 152 $\times$ 206, are all tallish, but it has not yet been possible to decide whether, in the natural variation in height, there is evidence that all the palms are in fact tall, supporting the first theory, or whether there is sufficient moderation in rate of growth to justify the second theory. Only further records and results of breeding, now in progress, will solve this problem, which must have fundamental effect on the policy of subsequent "dumpy" breeding.

216. Selections of superior palms have been made, with particular attention to "dumpy" palms (family 206), and breeding work was in progress throughout the year; 90 controlled pollinations were made in production of 81 pedigree families which are composed of dumpy selfs and crosses, dumpy $\times$ tall crosses backcrossed to dumpies, and tall selfs and crosses. Proposals for planting these pedigree families for continuation of the breeding programme have been put forward but adequate suitable land has not yet been found.

217. It is proposed to extend the range of selection by including in the programme selected palms from amongst the populations of pedigree and non-pedigree palms from other plantings. It is hoped also to be able to extend the range and basis of selection and breeding by introduction of pedigree stocks from elsewhere in Malaya and from overseas.

218. (b) "*Tenera*" Palms.—A representative collection of oil palm varieties from several sources in West Africa, planted in 1929, contain a number of lines of "tenera" thin-shelled type, and some "pisifera" shell-less palms. Average yields of these palms are considerably below those for comparable Deli palms on the Federal Experiment Station, Serdang, and it is not expected that they will provide any valuable material for the breeding programme. Importation of pedigree material from Nigeria is proposed.

219. (c) *High Carotene Selection*.—Records of bunches and fruit characters of individual palms in pedigree families at the Federal Experiment Station, Serdang, were continued. A large

number of these palms are infertile and have been cut out. With the arrival of a Botanist for full-time work on the Federal Experiment Station, Serdang, the selection of "high carotene" palms has been revived. A preliminary selection of 150 of these palms has been made for testing. These palms have been selected from the ten best yielders from each of 15 crosses and five from another. As soon as sufficient figures have been collected, a final selection will be made and the number of palms under observation reduced to 20 or 30. Palms producing fruits of lower oil-content and colour values will be discarded. Although all these palms are progenies of parent palms which produced fruits with oil of high carotene content, they have been disappointing in this respect and only about 25 per cent. reached the standard of the parents.

(ii) CHEMICAL INVESTIGATIONS.

220. (a) *Oil Content as a Basis for Selection.*—Samples of fruits were examined to determine whether there was any correlation between length of maturation period of bunches and the oil-content of fruits and the colour of oil. A similar test was also made with fruits from bunches at varying stages of ripeness.

221. A case of low recovery of oil reported from an estate was found to be due not to factory inefficiency but to poor quality of bunches which were badly covered with fruit, and to some of the fruit being inferior in oil-content. Pale yellow fruits from the inner layers on many bunches were much lower in oil-content than is usually experienced.

222. The completion of the fertilisation of all the flowers on the female inflorescences on the palms of family E. 206 has been observed to be irregular. The fruits on the bunches when harvested were partly undeveloped owing to failure to achieve fertilisation. The proportion of pericarp in the fully mature fruits was normal, but in the case of the parthenocarpic fruits this proportion was very high, in the region of 90 per cent. In view of the fact that the percentage of oil in the pericarp of these fruits was normal, the proportion of oil to fruit was, therefore, higher than that for the normal fruits. The nuts from the parthenocarpic fruits were nearly all rudimentary.

223. The analysis of fruit of high yielding palms in conjunction with a selection experiment on an estate was continued throughout the year and 71 bunches from these palms were examined. All the records have not yet been received from the estate. However, judging from the available figures, it would appear that as the palms recovered more fully from the neglect of the period of occupation of Malaya by the Japanese, the variability of yield of oil among the bunches tended to narrow again, especially in respect of bunches from the same palm.

224. (b) *Correlation between Leaf Analyses and Fruiting Cycle.*—The investigation with selected palms at the Federal Experiment Station, Serdang, to determine whether the variations in the nutrients in the leaf could be correlated with the fruiting cycle, which is an uncontrolled factor, was terminated after a

period of two years. The samples were taken from the third fronds (in numerical order) at each appearance of a new frond, that is at about fortnightly intervals, and analysed for N, P, K, Ca and Mg. Careful records were kept of the individual palms. It is not possible to draw any definite conclusions until the figures have been carefully studied, but, so far, there would seem to be no clear correlation between fruiting cycle and leaf composition. The potash content of the leaf ash tended to decrease progressively with the development of a bunch until it was harvested, after which this cycle more or less repeated itself with every new bunch. The general tendency, however, is for the composition of the leaf to be irregular and, unlike annual and other short-lived crops, shows more or less definite changes in relation to the growth and maturity of the plants.

(iii) MANURIAL EXPERIMENTS.

225. The manurial experiment at the Kuala Lumpur Experiment Station with a group of hitherto neglected palms, three of which received a heavy dressing of rock phosphate, three a heavy dressing of ammonium sulphate and the remaining palms a heavy dressing of muriate of potash, was continued. The palms which had been manured with nitrogen and potash received further light dressings of these fertilisers at two-monthly intervals. All these palms have maintained their improved appearance and have started to fruit again. Leaf analysis indicated that the N, P, K contents have increased.

226. A solitary palm was chosen on account of its severe bronzing and treated with a heavy dressing of rock phosphate placed in eight holes drilled into the ground in a circle around the bole at the radius of leaf spread. Five months later, a dressing of wood ash was lightly hoed into the soil around the palm. The palm has improved slightly in appearance. One of the holes into which the rock phosphate was placed was examined recently but there was no sign of any congregation of roots around or in the hole.

227. An experiment with oil palm seedlings grown in a nutrient solution maintained at different degrees of acidity, viz., pH 3.5, 4.5, 5.5 and 6.5 showed that the palms thrived better in the more acid solutions. After a period of two months the new leaves of the plants growing in the solutions maintained at pH 5.5 and 6.5 started to develop yellow spots, later a general yellowing and finally started to die from the tips. These conditions were more severe in the case of the plants growing in the solutions maintained at pH 6.5. The root systems of these plants were found to be not as well developed as those of the healthy plants.

228. A phosphate placement experiment was laid down at the Federal Experiment Station, Serdang. Proposals were made to conduct manurial experiments on estates, one with methods of placement and dressings of phosphate manures and the other with phosphate, potash and magnesium. One of each of these experiments will be laid down early in 1950 and it is hoped that the series will be extended.

(iv) EFFECT OF AGE AT TRANSPLANTING ON YIELDS.

229. In an unreplicated trial at the Federal Experiment Station, Serdang, yields have been as follows:

Plot.	Seed sown.	Seedlings planted.	Yield in lbs. weight of fruit bunches.			Total as per cent. of mean.
			1947.	1948.	1949.	
A ..	1938 ..	1939 (1 yr. old) ..	4,969 ..	10,511 ..	4,122 ..	113
B ..	1938 ..	1940 (2 yrs. old) ..	5,012 ..	11,372 ..	4,279 ..	119
C ..	1938 ..	1941 (3 yrs. old) ..	2,494 ..	5,793 ..	3,517 ..	68
Mean ..						100

It is clear that planting of over-aged seedlings has decreased the yield.

(v) INTER-ROW CULTIVATION BY MACHINERY.

230. The inter-row cultivation experiment at the Federal Experiment Station, Serdang, was continued but it is as yet too early to expect results. Proposals have been made to conduct similar experiments on estates and plans for one such trial are well in hand.

(vi) FELLING AND DISPOSAL.

231. Investigations into the felling and disposal of oil palms by mechanical methods and by poisoning with sodium arsenite have been described in the July number of the *Malayan Agricultural Journal*. Of the two mechanical methods tried, felling by bull-dozer was preferred to felling by means of a cable drawn between two tractors. In the poisoning method, 1 oz. of sodium arsenite per tree proved to be as effective as 2, 3, or 4 ozs. The cost of disposal of palms by this method is between \$2 and \$3 per acre.

(vii) OIL PALM DISEASES.

232. (a) *Stem Rot*.—Stem Rot, caused by *Fomes noxius*, was not prevalent during the year, only a few cases being recorded.

233. (b) *Wilt*.—Two types of "wilt" were observed on peat areas in Selangor. In one the leaves of an affected palm were of a light yellowish colour and were much reduced in size. In addition, the outer leaves died off prematurely so that gradually the crown decreased in size until the palm died. In the other case early stages of the trouble were marked by bronzing of the leaves. This was followed by the death of the outer leaves which became light grey in colour. Slowly the inner leaves also were successively killed until eventually the whole crown withered and the palm died. No parasite was found to be associated with either of these diseases.

234. (c) *Helminthosporium species*.—This was found to be attacking seedlings, killing off large areas of the young leaves as they emerged from the bud. This species has previously been reported as causing severe spotting and decay of the leaves of seedlings.

235. (d) *Fruit anthracnose*.—Symptoms of anthracnose developed on the fruits of one selection at the Federal Experiment Station, Serdang. Black sunken areas appeared at the apex of the fruit and spread downwards. On these areas the fungus *Glomerella cingulata* (conidial stage) was very common.

The disease was probably influenced by a check to nutrition caused by some adverse growth factor and the fungus is considered to be a secondary cause of the trouble.

(viii) OIL PALM INSECT PESTS.

236. Several species of caseworms (Psychids) were reported as pests, viz., *Pteroma* sp. near *plagiophleps* Hamps. in Johore, *Clania variegata* Snell in Perak and *Mahasena corbetti* Tams in Selangor. Agrocide 3 dust at 25 lbs. per acre gave good control. *Clania* was known previously from kapok and *Casuarina* but not from oil palm. Three other caterpillar pests were the nettle grub, *Setora nitens* Walk. (controlled with 30 per cent. lead arsenate dust in Perak and with Agrocide 3 dust in Johore), the tussock moth, *Orgyia turbata* Butl. and cutworm, *Prodenia litura* F. on seedlings.

237. The rhinoceros beetle, *Oryctes rhinoceros* L. was a pest in old oil palms in Selangor and the cricket *Brachytrypes achatinus* Stoll in nursery seedlings in Johore.

4.—COCONUT PALMS.

(i) SELECTION.

238. Routine collection was continued, throughout 1949, of further records of numbers of fruits and weight of copra per fruit from 225 individual palms, provisionally selected on such characters, both tall and dwarf, at the Federal Experiment Station, Port Swettenham, and on tall palms on a field of Division I, Carey Island Estate, with the kind permission of the Resident General Manager.

239. Oil analyses were made of copra samples from Port Swettenham. The oil content figures, calculated on a moisture-free basis, varied from 55.25 to 72.06 per cent. with an average of 64.71 per cent.; those for the Carey Island samples varied from 48.80 to 71.69 per cent., with an average of 63.55 per cent.

240. Sufficient data has been accumulated to enable final selection to be made amongst some of the palms, and the commencement of the initial stages of a breeding programme.

241. The accumulated data is at present being tabulated, together with observations on palm growth characters, and final selection is being based on a calculated index of copra and oil production per acre for each palm.

(ii) COCONUT PALM INSECT PESTS.

242. As was the case in 1948, an outbreak of *Artona catoxantha* Hamps. was reported from the Colony of Singapore. A combination of stormy weather and its Tachinid parasite *Ptychomyia remota* Ald., brought the caterpillars under control.

243. Reports of damage to palms by larvae of the skipper butterfly *Hidari irava* Moore, were received from Carey Island and Teluk Anson.

244. In this last area, damage was caused by the rhinoceros beetle *Oryctes rhinoceros* L. against whose grubs a clean-up campaign was conducted by the Agricultural Officer in Province Wellesley.

245. News has been received that the Eulophid parasite *Tetrastichus brontispae* (Ferr.), exported from Malaya in 1948 to Saipan and Rota Islands (north of Guam) has now become established and recovered in the field from pupae of the coconut Hispid beetle *Brontispa mariana* Spaeth.

5.—PINEAPPLE.

(i) BOTANICAL AND AGRONOMIC RESEARCH.

246. Schemes which had been made for a research programme to assist the pineapple industry made no progress either from the botanical or the agronomic aspect. The development of the proposed Federal Experiment Station in the Pontian District of Johore, the centre of expanding pineapple cultivation on peat, remained in abeyance owing to the emergency, and access to the district generally was restricted. At the end of the year some simple field experiments were agreed upon to be executed in co-operation with the principal growers.

247. Experiments in vegetative propagation were carried out at the Federal Experiment Station, Serdang. Peat beds were almost as good as sand beds. Rotting of $\frac{1}{2}$ in. cross sections and longitudinal slices was the chief problem. Treatments with "Perenox" and potassium permanganate were not effective in preventing this. Uncut full stems or stems cut in any manner longitudinally produced only one or two terminal buds. Continuation of trials with thicker cross section, sun-dried, will be made.

(ii) PINEAPPLE DISEASES.

248. As a result of a visit paid in August by the Entomologist to Kukub, Pontian, certain observations are being taken by the field staff of the State Agricultural Officer, Johore, on the relation between wilt and relative abundance of the mealybug *Pseudococcus brevipes* Ckll. Results should be available next year and it is hoped to duplicate the observations this year on another peat area near Batu Laut, Selangor, where wilt is also present.

(iii) PINEAPPLE SILAGE.

249. Samples of pineapple cannery waste which had been ensiled in pits at the Canning Research Station were analysed. The product made anaerobically, as in Hawaii, was decidedly superior in odour, flavour and appearance to that prepared in a pit without special precautions, and was likely to be much more palatable to livestock. Chemically, on the other hand, the two products were very little different.

(iv) CANNING RESEARCH STATION.

250. (a) *Rehabilitation*.—The Canning Research Station in Johore Bahru was almost completely restored in the course of the year from the effects of the Japanese occupation of Malaya, but progress was halted by the retirement of the Canning Officer in June, 1949.

251. The demonstration canning line, consisting of syruiping plant, can filling conveyor, exhaustor and sterilizer, was installed and is now ready to operate. The fruit preparation tables and the fruit washing and grading line are in position, but the belt conveyors have not yet been linked up; they are still without motors. The empty can conveyor has yet to be installed.

252. The middle scale processing laboratory is complete except for wiring for the pulping machine. The apparatus and equipment for the laboratory have nearly all arrived.

253. (b) *Dehydrated Pineapple*.—One of the principal investigations was the production of dehydrated pineapple. A laboratory scale drying tunnel was fitted up and dehydrated pineapple slices were prepared from fruit in three degrees of ripeness. It was found that only sound, unbruised, fully ripe fruit should be used and that to prevent any discolouration the wet slices should not come in contact with an iron surface. The colour of the product was sufficiently good that it was not considered worth while going to the extra expense of sulphuring the product.

254. (c) *Canned Products (other than Pineapple)*.—In order to explore means whereby pineapple canneries could be profitably employed during the off-season, attention was paid to the canning of local foodstuffs, including vegetables, fruit, fish and poultry. Satisfactory trial packs of the following fruit were produced: belimbing, rambutan, papaya, pomelo, jack fruit, and ginger, while jams were made from mangosteen, rambai, belimbing and pomelo. Among vegetables, spinach, kangkong, sweet potatoes and cow pea produced attractive packs. Curried fish and curried chicken presented little difficulty and were favourably reported on.

6.—TEA.

(i) SELECTION.

255. (a) *Lowland Tea*.—The 580 field bushes of lowland tea selected in 1948 at the Federal Experiment Station, Serdang, were taken out of plucking and manured, and allowed to grow, to enable cuttings to be obtained in 1950 for cuttings' rooting trials.

256. (b) *Highland Tea*.—Field selection of highland tea was continued at the Agricultural Experiment Station, Cameron Highlands, and bushes were provisionally selected and labelled.

257. The willing co-operation of several tea estates at Cameron Highlands was obtained, and arrangements have been made for staff of these estates to make their own provisional selections, and when the programme of the selection work at Cameron Highlands can be resumed early in 1950, clones from these estates will be included in the further trials at the Agricultural Experiment Station.

258. (c) *Selection for Quality*.—Particular attention will be paid to quality of tea, and a design of a small hand-roller was obtained to enable leaf from a single bush to be properly rolled and cured for individual bush quality tests.

(ii) EXPERIMENTS IN SOWING PRACTICES.

259. A small trial was put down to test the effects of sowing seed in various positions relative to emergence of the radicle. Results to-date are inconclusive.

(iii) VEGETABLE PROPAGATION INVESTIGATIONS.

260. A trial between cuttings, seedlings and buddings has been laid down on two sites at the Federal Experiment Station, Serdang, one on flat land and the other on a hillside. In both cases a good stand has been established.

(iv) TEA MANURIAL EXPERIMENT.

261. An experiment at the Federal Experiment Station, Serdang, started in April, 1948, to determine the optimum level of nitrogenous manuring was continued. The yields in lbs. of green tea are shown below:

Pre-treat- ment yields 17-11-47 to 16-4-48.	Yield as per cent. of mean.	Yields 17-4-48 to 16-4-49.	Yield as per cent. of mean.	Yields 17-4-49 to 31-12-49.	Yield as per cent. of mean.
N ₀ PK 1,380 ..	101 ..	3,713 ..	93 ..	2,686 ..	92
N ₁ PK 1,362 ..	99 ..	4,022 ..	101 ..	2,922 ..	100
N ₂ PK 1,376 ..	100 ..	4,193 ..	105 ..	3,197 ..	109

It would appear that even a heavy dressing of nitrogen at 120 lbs. per acre has not the maximum effect.

(v) MECHANISED PLUCKING OF TEA.

262. The trial with the "Tarpen" tea plucker was concluded and is described in the July, 1949, number of the *Malayan Agricultural Journal*. In general, it was found to be unsatisfactory.

(vi) TEA DISEASES.

263. (a) *Red Root Disease*.—Red root disease (*Ganoderma pseudoferreum*) continued to be by far the commonest and most destructive root disease of tea. In the experiment laid down in an infected area at the Federal Experiment Station, Serdang, to compare the number of bushes killed in an area from which all roots had been removed, with the number killed in an area cleared in the normal manner, the number of bushes killed was in the ratio of 1 : 4. It is considered that if badly infected areas are to be replanted, careful removal of all diseased roots is essential.

264. (b) *White Root Disease*.—Only one case of white root disease (*Fomes lignosus*) was recorded.

265. (c) *Blister Blight*.—Blister Blight (*Exobasidium vexans*) has recently appeared in Sumatra but has not yet been discovered in Malaya. In July, tea estates in the Cameron Highlands area were visited but no sign of the disease was found.*

266. (d) *Other Tea Blights*.—The commonest diseases noticed during the above-mentioned survey were brown blight, caused by *Colletotrichum camelliae* and grey blight, caused by *Pestalotia theae*. The former was also observed causing a severe leaf blight of young seedlings in the lowlands.

267. (e) *Red Rust*.—Red Rust (*Cephaleuros mycoidea*) was reported from two estates, one in Perak and one in Selangor and was observed at the Federal Experiment Station, Serdang, and at an estate in Cameron Highlands. Considerable damage was done by this alga, especially in one case in which large lesions were produced on the stems and considerable defoliation and die-back occurred.

(vii) TEA INSECT PESTS.

268. (a) *Mosquito Blight*.—Information on the life history, habits and control of *Helopeltis* spp. on Highlands tea was given in some detail in the April issue of the *Malayan Agricultural Journal*. The egg-parasite has been determined in Washington,

* The disease has now appeared—February, 1950.

U.S.A., as *Erythmelus helopeltidis* Gahan, a species new to science. Development within the *Helopeltis* eggs varies from 26 days in May (65.6° F.) to 42 days in November (63.5° F.) in the Highlands. As a matter of interest this developmental period was only 20 to 28 days in Kuala Lumpur at 81.3° F.

269. (b) *Minor Insect Pests*.—Minor pests reported during 1949 were: an Aphid *Toxoptera* sp.; the red coffee borer *Zeuzera coffeae* Nietn. in the branches; the bagworm *Brachycyttarus subtalbatus* Hmps. and the Lasiocampid *Suana concolor* Walk. on the leaves. Three genera of thrips found in the curled leaves of China tea at Tanah Rata, Cameron Highlands, were undetermined species of *Anaphothrips*, *Chaetanaphothrips* and *Taeniothrips*.

270. (c) *Ants*.—Nests of keringga ants (*Oecophylla smaragdina* F.) in tea bushes were causing trouble among pluckers in a tea estate. Application by means of a motor car horn bulb of 10 per cent. chlorinated camphene (Toxaphene) dust resulted in a good kill. This insecticide requires care in application and was dusted from windward with no adverse effects to the workmen.

(viii) TEA FERMENTATION.

271. Copper forms a part of the principal enzyme concerned in the fermentation of tea leaves. It was found that well-known brands of imported tea usually contained more copper than Malayan tea.

272. The experiment of spraying a weak solution of copper sulphate on the soil around tea bushes at the rate of 1 gm. of copper per bush in two selected areas was continued. The copper content of the leaves increased temporarily for a period of several pluckings after each spraying. In one of these areas there was an increase in the mean level of copper content of the leaf but in the other area where the initial level was higher there was no increase.

(ix) PACKING TEA SEED FOR TRANSPORT.

273. An experiment was carried out with the co-operation of the Manager, Boh Plantations, Cameron Highlands, to find the best method of packing tea seed. It would appear that tea seed packed in moist coconut fibre is likely to retain better viability over a period of nine weeks than seed packed in charcoal.

7.—COCOA.

274. Investigations on cocoa as a potential agricultural crop, to determine methods for its maximum multiplication rate, preliminary breeding and selection work on local material, importation of planting materials, work on diseases and pests of cocoa of local occurrence, and cocoa fermentation are described.

275. The existing limited number of cocoa trees in Malaya, in view of their long survival and apparent comparative suitability to local conditions, as well as the diversity of genetic make-up in those of trinitario type on Departmental Stations, were considered to be very suitable material for selection for expansion in the first place. Another type of cocoa to be mentioned is criollo, of which numerous isolated trees exist in many parts of Malaya. The possibilities of this type are to be investigated in comparison with trinitario, and perhaps as a source of stocks for budding.

276. It was also thought important to introduce other types from abroad, firstly to enhance the existing limited supply of local planting material and secondly with the possibility of finding material superior to that already existing. In contemplating importation of cocoa seed, provision had to be made for the rigorous exclusion of diseases affecting the crop in other parts of the world. A search was made for a suitable site in Malaya for an isolation nursery in which to raise seedlings under observation before their distribution, and negotiations eventually resulted in the lease from the Government of Singapore of a plot of land on Pulau Tekong, a small island to the east of Singapore Island. (See also Section IV—E, para. 543). One importation has so far been made, namely of seed of amelonado from West Africa. The seed was imported personally by air by the Senior Plant Pathologist, under the strictest precautions, and was germinated successfully in the isolation nursery. At the end of the year the basketed seedlings, under constant supervision, were growing well.

277. There was increasing difficulty in finding space on land of suitable character on Experiment Stations for planting experimental cocoa plots. Experiments were, partly for this reason, laid down co-operatively on private properties.

278. Early investigations into the growing of cocoa in Malaya are described in the April, 1949, number of the *Malayan Agricultural Journal*. A leaflet on cocoa has been published.

(i) BREEDING AND SELECTION—LOCAL MATERIAL.

279. The Department has four plots of mature cocoa at the Federal Experiment Station, Serdang, and State/Settlement Agricultural Stations at Cheras, Selangor, and Kuala Lipis and Temerloh, both in Pahang. All plots have been maintained and manured so as to obtain the maximum yield of pods, the beans of which have been used as planting material.

280. The year 1949 saw considerable development in a programme of selection and breeding of cocoa using as a foundation stock the trees available locally at the above-mentioned Departmental Stations. It is, therefore, of interest to record the sources of these trees. The trees in the half-acre plot at the Federal Experiment Station, Serdang, planted in 1934, are mostly out-pollinated progeny of one tree in the late Mr. Goh Hock Huat's orchard near Klang, with a few supplies obtained from seed from two pods from Ceylon. The trees at the Agricultural Station, Cheras (half-acre) are out-pollinated progeny of two selected trees planted at Serdang in 1938, with a few supplies of unknown origin. The trees at Kuala Lipis Agricultural Station are from seed from Serdang in 1927, so have presumably no relationship to the trees at present in the half-acre plot of the General Nursery at Serdang. The trees at Temerloh Agricultural Station are from out-pollinated seed from Kuala Lipis, planted between 1936 and 1940.

281. The following individual tree records are available: Complete records of the trees in the General Nursery at Serdang for 1937, 1938 and 1948; and records of numbers and weights of pods for the trees at Cheras for 1948.

282. Full recordings of numbers and weights of pods and fresh and dried beans were continued at Serdang. Numbers and weights of pods were also recorded at Cheras, but, of beans, only as large a proportion as was possible after supply of unopened pods to estates for seed purposes, was recorded.

283. Selection is based on the following characters and factors:

- (a) The number of pods per tree (maximum 120 pods per annum);
- (b) mean weight per pod (range: .5 lb. to 1.4 lbs.);
- (c) pod value, i.e., number of pods per lb. of dry cocoa (range: 9.6 to 27);
- (d) self-compatibility or otherwise; but records not quite complete.
- (e) size of tree—small trees preferred;
- (f) environmental effects (soil fertility variations, outside trees, etc.);
- (g) genotype range, affecting comparison of Serdang and Cheras trees.

284. Breeding was commenced in April and 820 pedigree seedlings of 19 families (including 2 from Pahang) were almost ready for planting in a comparative trial. Suitable land has yet to be found for this purpose. It is hoped to be able to extend the range of this breeding programme with imported seedling stocks.

(ii) COCOA VEGETATIVE PROPAGATION INVESTIGATIONS.

285. Considerable success was obtained at the Federal Experiment Station, Serdang, both in budding cocoa and in striking cuttings. With the selection of 20 trees, the first clonal trial was planted at the Federal Experiment Station, Serdang. Replications of this trial will be planted when further material is ready. A revision of the original list of selections was possible with additional records at the end of 1949, and a few substitutions were made. Cuttings for this first clonal trial were obtained from the mature mother trees, and a cuttings nursery has now been established for supply of better and more uniform material.

286. A further trial was put down to compare the performances of cuttings and buddings. From evidence in other countries, it would appear that cuttings are the best and most convenient form of planting material and steps are being taken to establish cutting-wood nurseries of half acre of each of the selected clones. Propagating bins of the Costa Rica type are being tested to see if, under Malayan conditions, the large-scale production of rooted cuttings may be effected.

287. Hormone treatment trials were carried out to improve rooting of cuttings, and indol butyric acid in an inert powder produced markedly the best results. Confirmation of these results is now being obtained in further experiments.

(iii) COCOA NURSERY.

288. In order to be able to supply large quantities of clonal material for Departmental and other experiments, a budded nursery for supply of cuttings was in process of being established as rapidly as possible at the Federal Experiment Station, Serdang.

(iv) INVESTIGATIONS INTO COCOA FIELD ESTABLISHMENT METHODS.

289. Trials of various methods of establishment were laid down in the form of eight experiments on agricultural stations and 21 experiments on estates. Methods, in general, approximated closely to those in use in the West Indies and were as recommended by Professor Cheesman in his report on the potentialities for the cultivation of cocoa in Malaya, published in 1948*. These methods necessitate the planting, before the cocoa is transplanted, of primary shades of bush cover crops, secondary shades of bananas or *Gliricidia* and tertiary shade of trees. It already seems clear that in most conditions in Malaya, cocoa is less intolerant of lack of shade than it is of root competition and the thinning out of primary shade or its removal and substitution by palm fronds almost invariably leads to an increase in the growth-rate of the cocoa. It may be assumed, therefore, that the establishment of primary shade of growing plants is more likely to do harm than good in Malaya. With regard to secondary shade, not only trinitario but criollo trees may be seen growing satisfactorily in the open without any shade. Consequently, serious consideration is being given to the point as to whether or not shading by growing plants is desirable.

290. At the Federal Experiment Station, Port Swettenham, a small area planted with seed at stake has done well and this treatment is being included in a more elaborate experiment at the Federal Experiment Station, Serdang, which will include plants grown in Java nurseries and in baskets for various lengths of time.

(v) INVESTIGATIONS INTO INTERPLANTING COCOA WITH OTHER CROPS.

291. Trials were started on estates and at the Rubber Research Institute's Station at Sungei Buloh, Selangor, to test the effect of planting cocoa with rubber, and, on estates, trials with cocoa with coconuts, oil palms and Manila hemp. In addition, cocoa was planted under mature rubber and coconuts, but only when isolation trenches were dug and constantly reopened between the main crop and the cocoa has the cocoa grown well; if this is not done the cocoa planting hole becomes filled with rubber or coconut roots and the cocoa makes little, if any, progress.

(vi) NEW COCOA AREAS.

292. With the proposal to open a new cocoa experiment plot on East Coast quartzite, several soil samples were submitted to the Soils Chemist from various areas by the State Agricultural Officer, Kelantan. Rock samples were also sent in and these were examined in an endeavour to locate an area which would be of a definite soil type. These soil and rock samples proved inconclusive but the Soils Chemist later visited the area and finally decided on a possible site.

(vii) COCOA DISEASES.

293. (a) *Root Diseases*.—The only root disease affecting mature trees is red root disease (*Ganoderma pseudoferreum*). This fungus also killed some trees when they were only two years old. In several areas planted within the past two years,

* Report on Potentialities for the Cultivation of Cocoa in Malaya, Sarawak and North Borneo. E. E. Cheesman. His Majesty's Stationery Office, London, 1948.

the young trees were killed by white root disease (*Fomes lignosus*). It would therefore appear that both *Ganoderma* and *F. lignosus* may be expected to cause some damage to young cocoa plantings in the future. Since attacked shade trees constitute an important source of infection by these diseases, the species of trees commonly being used as shade for cocoa were planted in an area, heavily infected by *Ganoderma*, at the Federal Experiment Station, Serdang, to discover whether any variation in susceptibility to that fungus exists in the different species.

294. (b) *Stem Canker*.—Stem canker, caused by *Cephaeleuros mycoidea*, occurred on young seedlings, causing their death. This alga also causes a leaf spot of cocoa and is found on dying twigs.

295. (c) *Malformations*.—A peculiar twisting of the stem of one year old cocoa plants was very common on one estate in Selangor and isolated cases showing the same symptoms were seen in an estate in Malacca. There was also a crinkling of the leaves of plants in these areas. No fungus was found associated with this condition and buddings of affected tissues on to healthy seedlings did not transmit the disease.

296. (d) *Nutritional Disorders*.—Seedlings are being grown in sand culture using various nutrient solutions to observe the effects of deficiency or excess of various elements on the growth of cocoa.

(viii) COCOA INSECT PESTS.

297. (a) *Newly Recorded Pests*.—In addition to those insects given in the report for 1948 (paragraph 319), the following have since been recorded doing damage to cocoa in the field:

298. (i) *Moths (Leaf-eating Caterpillars)* Lasiocampidae—*Suana concolor* Walk.; Lymantridae—*Euproctis* sp. near *atripuncta* Hmps., and *Dasychira basinigra* Hyl.; Geometridae—*Hyposidra talaca* Walk. and *Cleora transcissa* Walk.; Tortricidae—*Cacoecia epicyrta* Meyr. and *Homona picrostata* Meyr.; Limacodidae—*Orthocraspeda trima* Moore and *Setora nitens* Walk.; Noctuidae—*Heliothis obsoleta* F., *Prodenia litura* F., Arctiidae—*Creatanotus transiens* Walk. and *Asura* sp.

299. (ii) *Moths (Stem-boring Caterpillars)*.—*Zeuzera coffeae* Walk., also in kachang kayu (dahl) as shade trees. An unidentified bagworm (psychid) from *Albizzia moluccana*, grown as a shade tree also attacks cocoa.

300. (iii) *Beetles*: weevil—*Phytoscaphus lepotinus* Fst.; shot-hole borers—*Xyleborus morstatti* Hag. (Singapore only), *Xyleborus mancus* Bldf., *Stephandoderes alter* Eggers, *Stephandoderes* sp., *Hypothenemus* sp. near *areccae* Horn., *Hypothenemus* sp. near *bicolor* Schedl., chafers—*Chaetadoretus borneensis* Krtz., *Chaetadoretus cribratus* White, *Lepadoretus sinicus* White and *Anomala pallida* F. Thysanoptera—*Heliothrips* sp. near *haemorrhoidalis* (Bouche).

301. (iv) *Mealybugs*.—A small, oval mealybug was taken on very young shoots of cocoa seedlings on one estate, many of the plants having a marked curvature of the shoots and leaf-crinkling. The insect was sent by air-mail to London and, through the courtesy of the Director of the Commonwealth Institute of Entomology, it was identified as *Pseudococcus citri* (Risso), the citrus mealybug recorded on cocoa at Serdang in 1938.

302. A much larger mealybug with an erect, fluted egg sac, *Phenacoccus iceryoides* Green, was most abundant on kacang kayu (*Cajanus indicus*) but was also present on cocoa. It is invariably tended by the ant *Plagiolepis longipes* Jerd. Experimental spraying on dhal carried out by a firm dealing in insecticides showed that application of 9 cc. in 4.2 gallons of water of a 20 per cent. solution of E. 605 and TEPP (tetra-ethyl-pyrophosphate) gave adequate control with little leaf-scorching, the former chemical giving better results.

303. (b) *Chafers*.—The chafer *Apogonia cribricollis* Burm. continues to be a pest of the older leaves, rarely attacking the young flush. Observations show that cocoa grown under shade (either in the jungle or with erect palm leaves around the seedlings) suffer much lighter attack than plants grown in the open. Attempts have been made to control it by spraying with insecticides or by clean weeding and so destroying places of concealment for them. On certain estates, routine sprayings have been carried out which have often been done in full sunlight and it is considered that this has caused, in many cases, sun-scorch and defoliation. Trials are now being started to test methods of controlling *Apogonia* by agricultural means, that is to say by manurial and cultural methods. Lead arsenate, Wettable Agrocide sprays, Agrocide 3 and DDT dusts all give some control but require frequent renewal in wet weather. The white eggs are laid in the soil at a depth of $1\frac{1}{2}$ to 2 inches and hatch in from 7 to 10 days and develop into typical curved, white grubs which eat roots and vegetable matter. Feeding by the adult normally commences after 7.30 p.m. in the laboratory, the beetles will thrust themselves through netting $1/12$ in. in diameter though the insects measure $1/6$ in. across the body.

304. Four other closely related beetles do similar damage at night to the leaves; their names are given under "Newly Recorded Pests" above.

305. (c) *Mosquito Bug*.—The area at Cheras Experiment Station, Selangor, referred to in last year's report was dusted at the rate of 12 lbs. of Agrocide 3 per acre at 8 and subsequently 6-weekly intervals on 7 occasions during the year. This was found to check *Helopeltis theobromae* Miller and on the final (November) dusting, 5 per cent. DDT was substituted to compare its effect. This insecticide rose to only about 8 ft. compared with the 10 or 12 ft. cloud obtained with Agrocide. The presence of only one or two bugs per tree can result in heavy spotting of the pods so that a thorough cover of the trees is essential.

306. (d) *Stem-boring Caterpillars*.—Two species of Cossidae tunnel in the branches, the smaller *Zeuzera coffeae* Nietn., is the commoner and is known as the red coffee borer. It has been found also in dhal and *Peltophorum* grown as a shade, and the

larger *Z. conferta* Walk., also tunnels in dhal. Injection of a proprietary insecticide containing pyrethrum, by means of a "Wesco" oil pump, which has a suitable nozzle for introduction into the burrow, is the suggested control.

307. (e) *Other Caterpillars*.—The Lymantrid *Dasychira osseata* Walk. had been recorded previously as a leaf-eater but it was found this year feeding on the pod, making an extensive excavation reminiscent of squirrel or rat damage. The large, hairy Lasiocampid *Suana concolor* Walk., common on tea and cinnamon, was taken eating leaves of cocoa. The leaf-roller *Cacoecia epicyrta* Meyr.; the looper *Hyposidra talaca* Walk. (a black and white larva when young, greenish-brown when older) and the nettle grub *Setora nitens* Walk., all did damage to the leaves. Although not yet taken from cocoa, one specimen of the Java cocoa moth *Acrocercops cramerella* Snell. was reared from rambutan (see under Fruits).

308. (f) *Shot-hole Borers*.—Although there were pre-war records of shot-hole borers or ambrosia beetles in dried and decaying pods, only one of these beetles was recorded from branches, viz., *Xyleborus mancus* Bldf., then recorded as *X. abruptus* Samps.

309. During 1949, five others were found doing internal damage to the shoots of seedlings, viz., *Stephanoderes alter* Eggers, *Stephanoderes* sp., *Hypothenemus* sp. near *areccae* Horn., *Hypothenemus* sp. near *bicolor* Schedl., and *Xyleborus morstatti* Hag. (Singapore only). These are all small, brown, cylindrical beetles with the head flexed under the body and measure about 1 mm. in length. Apart from the field collection and destruction of infected branches, the only feasible control measures are application of one of the new systemic insecticides which alone will be able to reach the insects, all stages of which are passed inside the tunnels excavated in the stems or branches.

(ix) COCOA BEAN FERMENTATION INVESTIGATIONS.

310. In connection with the breeding programme, it may be necessary to be able to assess the quality of beans from a few pods which may ripen at any one time on a single tree selected as a clonal parent or a seed bearer.

311. Experiments were begun to devise a satisfactory method of small-scale fermentation and drying of beans. During the early part of the year pods from Temerloh Experiment Station, Pahang, were utilised for these experiments. Buchner funnels of three sizes were used to contain the fermenting beans, and were kept in a chamber with controlled temperature and high humidity. Fermentation, as such, proceeded without difficulty and the fermented beans were dried in a current of warm air. Nevertheless, samples of the processed beans, sent to a well-known manufacturer of chocolates in the United Kingdom, were not favourably reported upon. Experiments continue and modifications in the fermentation method will be tried in future tests. The variation between different small batches of beans in proportion and character of pulp is likely to be an obstacle to standardised procedure.

8.—DERRIS.

(i) SELECTION.

312. Further work in the re-selection of clonal *Derris elliptica* (Changi 3), necessitated by mixing and confusion of stocks by the Japanese, was prevented by a fungus defoliation of the young shoots.

(ii) DERRIS FIELD ESTABLISHMENT.

313. Four methods of establishing derris in the field were tested in an experiment at the Federal Experiment Station, Serdang, thus:

- (i) planting direct into the field;
- (ii) planting direct in the field with the addition of a grass mulch;
- (iii) planting in nursery beds under shade and transplanting after one month;
- (iv) planting in nursery beds under shade and transplanting after two months.

There was no significant difference between the treatments.

9.—CASHEW NUT.

(i) SHELLING TESTS.

314. Cashew nuts from Pahang were submitted to shelling tests, which showed that they could be shelled more successfully if harvested when fully ripe.

10.—PEPPER.

(i) PEPPER CULTIVATION AND MANURIAL EXPERIMENTS.

315. In conjunction with a plan to produce planting material of pepper, now in great demand, an experiment was laid down at the Federal Experiment Station, Serdang, to compare pepper grown on living supports and on dead supports. Each main treatment is sub-divided into three for manurial treatments. It is proposed to duplicate this experiment at Pekan Agricultural Station, Pahang.

11.—FRUIT TREES.

(i) SELECTION.

316. The policy of the Department is to produce improved planting material for sale to the public by selecting the best trees in all States and Settlements, the fruit of which is sent to the Federal Experiment Station, Serdang, for testing. If the fruit is found to be well above standard, budwood or budded plants are sent to Serdang and the clone is multiplied there. Later, budded plants are sent to State and Settlement Agricultural Stations and on these stations multiplication takes place to produce material for sale to the public. The present position with regard to each species is as follows:

317. *Annonaceous Fruits*.—A few selected Bullock's Heart and Soursop have been registered.

318. *Artocarpus Fruits*.—Four clones of Chempedak and two of Nangka have been selected and budwood will be available on a large scale in 1950.

319. *Avocado Pear*.—Ten Avocado Pears have been selected and budwood multiplication nurseries of five have been established.

320. *Chiku*.—Four clones have been selected and budwood will shortly be available at Serdang, but no really successful method of vegetative propagation has yet been found.

321. *Citrus*.—One Lemon, two Limes, three Mandarin Oranges and four Pomeloes have been found to be of good quality and suitable for Malayan conditions. Budwood is, or shortly will be, available and investigations into methods of propagation, especially with a view to selecting stocks which are not susceptible to canker or gummosis, continue.

322. *Durian*.—Fourteen good trees were selected and budwood nurseries of 12 have been established at Serdang.

323. *Mango and Kuini*.—There are 7 selected mangoes and 3 selected Kuinies; of most of these budwood is available.

324. *Mangosteen*.—Trees are being selected at the Federal Experiment Station, Serdang, and it is considered that seedlings generally grow true to type.

325. *Rambutan and Pulasan*.—Twenty-three clones of the former and 11 clones of the latter have been selected and budwood multiplication beds have been established at Serdang.

326. *Bananas*.—Identifications of individual stools of a collection of Malayan varieties were made and the identified clones were replanted at the Federal Experiment Station, Serdang. A number of additions to the collection have also been made by collection in the kampongs, and named varieties now total fifty-seven.

327. *Other Fruits*.—Several identifications, and reports on quality of other fruits, were made for State Agricultural Officers.

328. *Arecanut*.—A register of good palms is kept, and analyses of fruit samples of such local selections is made as occasion requires.

(ii) VARIETY TRIALS.

329. Variety trials with 13 clones of durians and 15 clones of rambutans were laid down at the Federal Experiment Station, Serdang, and another with 15 clones of rambutans at Ipoh.

(iii) FRUIT TREE INSECT PESTS.

330. (a) *Chiku or Sapodilla*.—The new fruit-boring caterpillar found on Chiku (*Achras sapota*) and referred to in last year's report has now been specifically identified by the Commonwealth Institute of Entomology as an undescribed species of *Salebria*. Besides Singapore and Kedah records, this insect has since been taken in Perak, Penang and Selangor and is evidently fairly well distributed throughout the Peninsula.

331. (b) *Citrus*.—Larvae of the fruit fly *Dacus dorsalis* Hend. were found in fruits of lime; larvae of the swallow-tail butterfly *Papilio polytes* L. on pomelo leaves and the "white flies", *Aleurocanthus woglumi* Ashby, and *A. spiniferus* Quaint. on lemon leaves. Larvae of the fruit-boring *Citripestis sagittiferella* Moore were found inside growing Canton lemons in Singapore.

332. (c) *Durian*. (*Durio zibethinus*). Another fruit-borer, the Noctuid *Plagideicta magniplaga* Walk., occurred in fruits from Penang. A species of *Asterolecanium* scale was present on leaves from Ayer Hitam, Johore.

333. (d) *Mango*.—The smaller mango weevil *Cryptorhynchus gravis* F. was forwarded from an Agricultural Station near Alor Star, Kedah, and in fruits imported from Siam to Kota Bharu, Kelantan. Immature specimens were collected in fruits at Pulau Tekong, east of Singapore Island.

334. An undetermined Psyllid or jumping plant-louse caused galls on the leaves.

335. (e) *Rambutan*.—(*Nephelium lappaceum*). A solitary caterpillar of the Java cocoa moth *Acrocercops cramerella* Snell. was reared from a rambutan fruit bought in January in the Kuala Lumpur fruit market. This is the first record of a live specimen in Malaya; unfortunately it was not possible to know whether or not it arrived in the fruit from overseas. Damage was done in Selangor to flowers and shoots by caterpillars of the Noctuid *Serrodus campana* Guer. and in Perak to the stems which were ring-barked by larvae of the Arbelid *Indarbela* sp.

336. A species of *Lepidosaphes* scale occurred on the leaves with another scale so heavily attacked by the entomogenous fungus *Aschersonia* as to be unidentifiable.

337. (f) *Fruit Flies*.—These insects were bred as follows: (i) *Dacus umbrosus* (F.) from chempedak (*Artocarpus polyphema*) and jack fruit (*A. integrifolia*), (ii) *D. ferrugineus* Hend. (*D. dorsalis* Hend.) from *Averrhoa carambola*, *A. bilimbi*, *Eugenia jambos*, mango, *sapodilla* (*Achras sapota*) and rambutan; (iii) *D. garciniae* Bezzi from *Garcinia dulcis*.

(iv) FRUIT TREE DISEASES.

338. (a) *Durian*.—A disease of young durians (*Durio zibethinus*) in which large areas of the leaves were killed and in which leaves were shed and a die-back of the branches took place, was caused by *Rhizoctonia solani*. Sclerotia of the fungus were formed profusely on fallen leaves.

12.—CLOVES.

(i) CLOVE INSECT PESTS.

339. The life-cycle of the two Cerambycid beetle borers, *Aphrodisium brevicorne* (Franz) and *Niraeus tricolor* (Newm.) is from 12 to 14 months of which 10 to 11 months are spent in the larval stage which is the destructive phase. The larvae are most abundant in the field from August to October and least so from February to April which is the peak period for the laying of the yellowish-orange eggs which hatch in from 12 to 16 days. This work was done in the vicinity of Balik Pulau, Penang, by an Agricultural Assistant and was terminated in mid-May after eighteen months' residence.

340. Various insecticides were tried against these pests, some as bark treatments for possible residual effect against adults alighting for the purpose of ovipositing, or merely resting on the bark, others for injection of the larval burrows. The bark treatments were not promising, and among the new

preparations only Chlordan emulsion concentrate, at 4 per cent. strength, showed promise when used for injection. This was slightly better than injections of orthodichlorobenzene.

341. Painting the bark is impracticable as a field measure and injection into the burrows requires more care than is necessary for the rough and ready though practical methods of inserting a hooked, brass wire probe to kill the grubs *in situ*.

342. Only one of the Ichneumon larval and pupal parasites has been identified, *viz.* the black-bodied, smoky-winged *Dinocryptus niger* Cam. A most interesting find was a Coleopterous parasite *Dastarcus porosus* Walk. of the family Colydiidae. Its larva emerges from the larvae and pupae of *Aphrodisium* forming a parchment-like cocoon in the cell in which the host larva pupates. It has previously been recorded from the mango borer.

343. Minor pests were the Arbelid *Indarbela* sp. near *acutistriata* Mell. which bores into the branches to a depth of 1 to 2 in. and constructs a covered runway of powdered bark and webbing beneath which it shelters, and the larva of the Xylorietid *Paralecta antistola* Meyr., which bores into forks of the smaller branches covering its burrow with a mass of frass.

344. The scarlet Mirid referred to in last year's report is *Arthriticus eugeniae* Bergr. and its sucking damage to leaves of young shoots may result in local defoliation following the drying and wrinkling of the leaves.

13.—FIBRES.

(A).—Manila Hemp.

(i) CLONAL SELECTION AND OBSERVATIONS.

345. Identification of clonal stocks at the Federal Experiment Station, Port Swettenham, and the Agricultural Station, Temerloh, continued and the majority of the material was assigned to one of the known varieties in Malaya.

346. The replanted clonal observation plots at the Federal experiment Station, Serdang, have not grown entirely satisfactorily on account of the relatively poor soil conditions.

(ii) CLONAL VARIETY TRIAL.

347. The variety trial at the Federal Experiment Station, Serdang, has come into bearing and measurements of tensile strength are being made.

(iii) CULTIVATION, MANURIAL AND VARIETY EXPERIMENTS.

348. Wet weather unfortunately held up the establishment of a comprehensive cultural, manurial and variety experiment to be planted at the Federal Experiment Station, Port Swettenham.

(iv) GROWTH OBSERVATIONS ON ESTATES.

349. In addition to these experiments on Agricultural Stations, Manila hemp has been planted on four estates and records of its performance are being obtained by the State Agricultural Officers concerned.

(B).—RAMIE.

(i) CLONAL COLLECTIONS AND OBSERVATION.

350. The collection of selected clones of *Boehmeria nivea* at the Federal Experiment Station, Serdang, was increased by more than 60 during 1949, and now totals 120. The additional clones have been obtained from various sources, both local and overseas, including seedling stocks from Australia and Hawaii. Considerable variation, as expected, was observed between the clones in this collection in respect of height, tillering habit and maturation period, and further selection will be made in due course. A technique for estimation of fibre content and quality of small samples is being worked out. Interchange of clonal material has been made with a few interested planting firms.

(ii) GROWTH OBSERVATIONS AND MANURIAL EXPERIMENTS.

351. (a) *Peat Soils*.—In order to study the growth of ramie on peat, a randomised block experiment was laid down to test the effect of 8 different treatments. These included dressings of sulphate of ammonia, rock phosphate and muriate of potash singly and in combination as N.P.K., triple potash, and also three trace elements consisting of copper sulphate, zinc sulphate and manganese sulphate. The dressings were applied at the same rates as those given to padi planted in pots of this peat, i.e., 2 cwts. per acre sulphate of ammonia, 4 cwts. per acre rock phosphate, 2 cwts. per acre muriate of potash and 75, 25, and 25 lbs. per acre of copper sulphate, zinc sulphate, and manganese sulphate respectively. The rhizomes were planted under favourable conditions on an area of peat which had been cleared of lalang and *belukar*, but the growth was poor on every plot and all the treatments appeared to be without effect. The plant came up a few inches above the ground, but then turned an unhealthy yellow colour and remained moribund. A half-acre block in the same area was burned and planted. The burning was carried out by gathering together rubbish, roots and pieces of wood and also a surface scraping of the peat into drills about 4 ft. apart and burning them. The rhizomes were then planted in this burnt material. At first the plants grew well and had a green and healthy appearance, but, on reaching the height of 3 to 4 ft., they began to turn yellow and stopped growing. It appears that the good effects of the burning disappeared fairly quickly.

352. With peat the problem is that while padi responded well to nitrogenous and other manures, there was no response from ramie on the same soil and with the same manures.

353. (b) *Mineral Soils*.—As noted in the 1948 report, two ramie manurial experiments had been laid down on mineral soils, one on yellow quartzite and the other on coastal alluvium. The experiment on yellow quartzite has had to be abandoned as growth, even with manuring, was very poor and the plants eventually began to die out. This bears out the conclusions noted in the 1948 Report that, even with manuring, ramie will not succeed on a poor soil.

354. In the case of the plot on coastal alluvium soil, the ramie has continued to grow reasonably well and is being used as a source of planting material.

355. Soil samples were taken on an estate where it was stated that ramie on an arsenic sprayed area showed better growth than that on the adjacent area which had not been sprayed. On analysing the soils for arsenic, however, it was found that there was little difference in the arsenic content of the sprayed and unsprayed areas. A visit to the estate confirmed the view that the arsenic was not responsible for the improved growth on the small area concerned but that it was probably due to the area being burnt over previous to planting.

(iii) RAMIE FIBRE EXTRACTION TESTS.

356. A few laboratory experiments were made on extraction of fibre from ramie canes in connection with Departmental cultivation tests.

(iv) RAMIE DISEASES.

357. Ramie (*Bochmeria nivea*) was killed by brown root disease (*Fomes noxius*) on an estate in Perak. In a trial to test the susceptibility of ramie to the common root disease fungi, in which the ramie was planted in close proximity to pieces of diseased roots, one plant was killed by *Fomes noxius* four months after planting. So far (after five months) no plants have been killed by the other fungi being tested (*Ganoderma pseudoferreum* and *Fomes lignosus*). Other diseases of this crop which have been noted are a decay of the roots caused by a species of *Phytophthora* and a leaf spot caused by *Cercospora fukuii*.

(C).—OTHER FIBRE PLANTS.

(i) GROWTH OBSERVATIONS.

358. Observation plots of the following local fibres, which, it is considered, might be possible alternatives to jute, were planted at the Federal Experiment Station, Serdang:

Hibiscus macrophyllus.

Hibiscus abelmoschus.

Hibiscus sabdariffa.

Urena lobata.

Sansevieria spp.

(ii) FIBRE ASSESSMENTS.

359. The fibrous barks of *Commersonia bartramia* and *Trichospermum kurzii* were examined as possible sources of a jute substitute. These barks in the form of narrow strips have found considerable local use for cordage, but there appeared to be no easy way of extracting the fibre.

14. VEGETABLES.

(A).—LOWLAND VEGETABLES.

360. Investigations with lowland vegetables were conducted at the Federal Experiment Station, Serdang, and in the Experimental Plantation, Kuala Lumpur. It is the general principle that vegetables are planted only to answer specific questions regarding the comparative value of varieties for manurial or cultural treatments, to observe the growth of the local or introduced species, to carry out initial multiplication of varieties for distribution to State or Settlement Agricultural Stations or to maintain a seed supply. Work at present is being restricted to cowpeas, soya-beans, spinach, cucumber and brinjals.

(B).—HIGHLAND VEGETABLES.

(i) VARIETY TRIALS.

361. In order to extend the range of vegetables produced at Cameron Highlands, seed was imported from United Kingdom, America, Australia, Java, India and Holland. A comprehensive series of variety and varietal-cum-manurial trials were conducted and it was shown that satisfactory crops of many types which are not normally grown at Cameron Highlands can be obtained. The following varieties gave good yields :

Vegetables.	Variety.	Origin.
Cucumber	Burpee's Hybrid ..	Burpee's (U.S.A.)
French beans	Tender Green	" "
French beans	Dwarf Stringless Green Pod	Zwaan's (Holland)
Beet	Lutz Green Leaf ..	Burpee's (U.S.A.)
Sweet corn	Stowell's Evergreen Hybrid	" "
Lettuce	Big White Boston ..	" "
Petsai	Petsai	" "
Early cabbage ..	Early Jersey Wakefield	" "
Early cabbage ..	Glory of Enkhuizen ..	Govier (Canada)
Celery	Golden Self-Blanching ..	Burpee's (U.S.A.) or Govier (Canada)
Sweet pepper	Merrimack Wonder ..	Burpee's (U.S.A.)
Sweet pepper	Early Pimento	" "
Cauliflower	Burpeeana	" "
Squash.. ..	English Vegetable Mar- row White Bush	Govier (Canada)

(ii) MANURIAL TRIALS.

362. It was considered that the widespread use of prawn dust at Cameron Highlands was undesirable for several reasons and a series of experiments was initiated to determine whether its place could be taken by artificial manures or compost. A series of experiments of this type must necessarily be continued over a long period but it is safe to say that certain garden fertilisers gave yields of cabbage, French beans and carrots as heavy as those obtained with prawn dust, and for a smaller expenditure.

(C).—VEGETABLE DISEASES.

363. *Brassica spp.*—Several records of diseases hitherto unknown locally were made on various species of Brassica. These included leaf rot of kai choy (*Brassica juncea*) caused by *Sclerotium rolfsii*, downy mildew of choy sam (*Brassica rapa*) caused by *Peronospora parasitica*, soft rot of kai choy, choy sam and kai lan (*Brassica alboglabra*) caused by *Bacterium carotovorum*, mosaic, suspected to be due to a virus of kai choy, choy sam, pak choy (*Brassica chinensis*) and lobak (*Raphanus sativus*), and leaf spot of cabbage (*Brassica oleracea*) caused by *Alternaria brassicicola*.

364. Leaf spots of various vegetables were found to be caused by a species of *Myrothecium*. Commonly attacked were long bean (*Vigna sinensis*), soya bean (*Glycine max*), four-angled bean (*Psophocarpus tetragonolobus*), brinjal (*Solanum melongena*) and loofah (*Luffa acutangula* and *L. cylindrica*), while attack on

ladies' finger (*Hibiscus esculentus*) and groundnut (*Arachis hypogaea*) was rare. Other hosts of this fungus were castor oil (*Ricinus communis*) and blue salvia (*Salvia farinacea*).

(D).—VEGETABLE INSECT PESTS.

365. The following insects all reached pest status during the year; the caterpillars of *Sylepta derogata* F. on leaves and of *Earias fabia* Stoll in the fruits of ochra; the cotton-strainer *Dysdercus cingulatus* F. on ochra; caterpillars of *Psara bipunctalis* F. and larvae and adults of *Epilachna indica* Muls. on brinjal; the bugs *Nezara viridula* L. and *Riptortus pedestris* F. on long beans (Kedah) and the boring caterpillars of *Zeuzera coffeae* Nietn. and *Z.conferta* Walk. on dhal grown as a shade for cocoa (Selangor).

366. Fruit flies from cucurbits were: (i) *Dacus cucurbitae* Coq. in loofah, cucumber, bitter gourd (*Momordica charantia*), snake gourd (*Trichosanthes anguina*) and cowpea; (ii) *D.caudatus* F. in bitter gourd and cucumber and (iii) *D.latifrons* Hend. in chilli (*Capsicum annuum*).

15.—SOYA BEAN.

(i) VARIETY SELECTION AND TRIALS.

367. Two further (the 3rd and 4th) generations of the soya bean selections were harvested during 1949, and the fifth generation sown in replicated field trials.

368. The third generation consisted of 90 strains of 13 of the original 38 varieties. From these, 1,000 field selections were made, but were reduced to 117 after laboratory measurements and comparisons of plant yields, and pod, bean and plant characters, and varietal averages. The fourth generation in turn resulted in 54 selections of nine original varieties, and these have been sown in replicated field trials at the Federal Experiment Station, Serdang. Growth is satisfactory, particularly when it is understood that the crop is being treated as a field crop, and not given especial manurial or cultural treatment. This has been the policy throughout the course of this selection work, for the crop can only be economic if so considered. The possible application is as an off-season crop in padi fields.

369. The two most successful varieties of soya beans are one of those which have been grown locally by Chinese, and a variety imported from Java. The varieties obtained from the U.S.A. mature rapidly and give relatively poor crops. It was believed that this was due to the low Malayan latitude and high temperatures, but to make sure that it was not also due at least in part, to lack of suitable nodule bacteria, appropriate *Rhizobium* inoculum was obtained from the Department of Agriculture, U.S.A., and soil inoculation was made from these varieties at sowing in June, 1949. This resulted, however, in no improvement in the growth of these American varieties, and it appears sufficiently clear that they are unadapted to the Malayan latitude and climate. Four selected American strains were, however, included in the last series of selection, including two of Seminole and one of Palmetto received direct from the United States Department of Agriculture, and Oototan Black Forage from Puerto Rico, although their yields have been much inferior to those of the best local and Java strains.

370. The most successful introductions, other than the Java importation, are two varieties, Sri Sumrong and Ang Thong, from Thailand, and five strains of Thailand origin were still included in the trials.

371. Provisional selections from third generation crops were sown in March at the Federal Experiment Station, Serdang, in an exploratory field trial. Strains 1628, 1631, 1618 were significantly superior to 1620, and average yields approximated to 1,500 lbs. per acre, which is much better than was expected and can be regarded as very satisfactory.

372. In addition to the replicated field trials of 5th generation selections sown in November, 1949, at the Federal Experiment Station, Serdang, and now growing, small trials were also established at six representative Agricultural Stations to observe differential behaviour of 18 of the most promising strains in different environments. An observation plot of one strain segregating for several characters has been planted in Kuala Lumpur for genetical study.

373. Samples of beans of 30 of the highest yielding strains have been analysed and show high protein values and good average oil contents.

16.—SWEET POTATOES.

(i) VARIETY CLASSIFICATION.

374. Initial records of differences of morphological characters amongst the varieties in the collection of sweet potatoes at the Federal Experiment Station, Serdang, were completed, except for those for tubers. The tubers were almost completely destroyed by rats. The plot has been replanted to obtain the necessary data. A preliminary key for identification of Malayan varieties has been drawn up but observation is being continued to resolve apparent differences between the more similar varieties.

(ii) VARIETY TRIALS.

375. Sixteen varieties, selected from 58, were tested in a variety trial at the Federal Experiment Station, Serdang, and the best 10 were then further tested at Serdang, Penang, Malacca and Kelantan, all 14 trials being planted in March-April and harvested in August-September, 1949. The results on the whole were remarkably similar and it is clear that Hoey Tong, Serdang I, Ampat Bulan and Large White are the best for Malayan conditions. The optimum harvesting period for these varieties appears to lie between 120 and 135 days.

17.—TOMATOES.

(i) TOMATO DISEASES.

376. (a) *Bacterial Wilt*.—In a previous pot experiment it was found that at the dosage normally used, DD soil fumigant had no effect on the incidence of bacterial wilt (*Xanthomonas solanacearum*). A field experiment using larger amounts of the chemical was carried out during the year. With high dosages (8 and 16 c.c. per sq. ft. of soil) the action of the parasite was inhibited to a considerable extent, especially in the earlier stages of the growth of the tomatoes. Later, however, all the plants succumbed to the disease. The test was a severe one as the

weather during the experiment was very wet and the soil used was extremely heavily infected with the wilt organism. It seems possible that satisfactory control of the disease might be obtained under more favourable conditions.

377. (b) *Fruit Rot*.—A rot of unripe fruits was found to be caused by *Phytophthora parasitica*: this is the first record in Malaya of that fungus on tomato.

18.—IRISH POTATOES.

(i) POTATO DISEASES.

378. (a) *Potato Blight*.—Nine varieties of potatoes resistant to blight (*Phytophthora infestans*) were received from Holland for trial at Cameron Highlands. All the varieties showed resistance to the disease under local conditions. So far it appears that the variety Voran is the most successful introduction as besides being blight resistant it makes very vigorous growth under the climatic conditions at Cameron Highlands.

19.—TAPIOCA.

(i) VARIETY TRIAL.

379. A variety trial laid down at the end of March, 1948, with 12 varieties showed that Kekabu, Unnamed 32, Medan and Berat gave the best yields. The optimum harvesting period lies between 10 and 12 months. Arrangements are now being made to test these varieties on State and Settlement Agricultural Stations.

20.—MAIZE.

(i) VARIETY TRIAL.

380. A variety trial between two pure strains and three hybrids planted at the Federal Experiment Station, Serdang, gave the expected result that the Hybrid Burma White yielded best, with the Hybrid Burma Yellow slightly lower and the pure strains giving the lowest yields. Yields of grain were rather low due to a heavy attack by stem borer, and the experiment is to be repeated.

(ii) MAIZE INSECT PESTS.

381. (a) *Stalk-borer*.—The only serious pest of maize is the stalk-borer *Pyrausta* sp. near *nubilalis* Hbn., the well-known European corn-borer of the United States. This insect had previously been referred to in Malaya as *P. salientialis* Snell. which is common in India, though material from Java, Sumatra, Philippines and Guam has always been regarded as *nubilalis*.

382. An insecticidal test was laid down in which Wetttable DDT, 5 per cent. DDT dust and Agrocide 3 dust were applied thrice at weekly intervals on a variety trial at the Federal Experiment Station, Serdang. The first application was made four weeks after planting and during the two weeks' period six inches of rain fell; this amount is unlikely to be exceeded. The result of the test will be available early in 1950: observations so far show that four applications are likely to be the minimum. required to reduce damage to a low figure. The incubation period of the egg is five days and the pupal period lasts seven days.

383. (b) *Leaf-hoppers*.—Minor damage was done by the leaf-hopper *Perkinsiella saccharicida* Kirk.; the aphid *Aphis maidis* Fitch and, a new record, by the click beetle, *Anathesis laconodoides* Cand.

21.—GROUNDNUTS.

(i) VARIETIES.

384. It has been shown that strains exist in Malaya which are capable of yielding about 20 per cent. more than the types normally grown. It is clear, therefore, that there is a profitable field for selection. Trials are now being conducted and some plant-to-row lines are being maintained at Serdang. Investigations into maturation periods show that 100 days should be regarded as optimum for most of these varieties.

385. Eleven groundnut experiments have been completed since the liberation, and a revised leaflet on groundnuts has been published. An article for the *Malayan Agricultural Journal* on groundnuts has been prepared.

(ii) CULTIVATION INVESTIGATIONS.

386. It has been shown that there is no advantage in planting on beds as against planting on the level except where, as in padi fields, water-logging is likely to occur. In planting distance experiments, in which treatments ranged from 6×6 ins. to 24×24 ins., 12×12 ins. has been found to be the optimum spacing, having regard to the fact that the amount of seed required to plant an acre must be balanced against the expected yield.

(iii) MANURIAL INVESTIGATIONS.

387. Lime up to 30 cwts. per acre has been shown to increase yield on clay soils. On these clay soils farm-yard manure applied to limed plots produced no significant increase in yield, but when no lime had been applied, farm-yard manure gave a significant increase over control. However, lime alone even at the lowest level gave a higher yield than farm-yard manure alone.

388. Phosphate and potash when applied to long-cultivated valley quartzite soils did not produce an increase in yield.

22.—FODDER GRASSES.

(i) VARIETY AND MANURIAL EXPERIMENTS.

389. Investigations into fodder grasses continue and three further trials have been started at the Federal Experiment Station, Serdang. The first is a varietal and manurial trial containing Guatemala, Napier and Guinea grasses, manured with both artificials and farm-yard manure. The remaining two have been designed to test the manurial requirements of Guinea grass, one containing all combinations of nitrogen, phosphate and potash and the other increasing amounts of sulphate of ammonia.

23.—PASTURE.

390. The comprehensive programme for investigations into pasture which was described in the 1948 annual report has been continued.

(i) METHODS OF ESTABLISHMENT.

391. An additional trial has been started to test methods of pasture establishment other than by hand-planting of root divisions. The treatments involve the discing in of grass runners cut to suitable lengths and the use of mechanical transplanters.

(ii) WEED SURVEYS IN PASTURES.

392. Weed surveys, by line transects, have also been made and frequency counts have been analysed.

(iii) PASTURE YIELDS.

393. Yield records have also been analysed; early grazing and hand-weeding appear to be detrimental. The plots sown with *Axonopus affinis* have yielded more than those planted with cuttings of *Axonopus compressus*, but not always significantly so. There is, as yet, relatively little tree shade established in the plots so being treated.

24.—WEED CONTROL INVESTIGATIONS.

(i) GENERAL.

394. A summary of the results of exploratory trials on the selective weed-control effects of various growth-regulating chemical substances (2, 4 D, etc.), was published in the *Malayan Agricultural Journal* in October, 1949. The chief points determined were that Water Hyacinth (*Eichornia crassipes*) and several similar broad leaved species were rather easily destroyed by standard applications, but that many other weeds required heavier doses than are generally effective in temperate climates, and that the chief Malayan weed species, namely lalang *Imperata cylindrica*, grass weeds of padi fields and water courses, and nut grass (*Cyperus rotundus*) in cultivated land were, as yet, unaffected by these hormone weed-killers.

(ii) LALANG.

395. Investigations into the control of lalang (*Imperata cylindrica*) by spraying and mechanical cultivation or combinations of the two have been described in the July, 1949, number of the *Malayan Agricultural Journal*. Observations into the control of lalang by grazing are being continued.

(iii) SENSITIVE PLANT.

396. Attempts are being made to control *Mimosa pudica* by mowing, cultivation with toothed harrows and spraying with hormone weed-killers and combinations of these. A preliminary experiment with various strengths and types of hormone weed-killers gave promising results which do not appear to be substantiated when the operation is conducted on a field scale.

(iv) NUT GRASS (*Cyperus rotundus*).

397. The control of nut grass is essential in the cultivation of most short-term crops. Mechanical cultivation and hormone weed-killers have been tested but wet weather interfered with spraying trials and no cheap and effective method has so far been found.

25.—MECHANISATION INVESTIGATIONS (OTHER THAN WET PADI).

398. Considerable research was conducted into the possibilities of mechanisation in dry-land conditions. Certain mechanical operations, especially those concerned with land preparation, are common to all crops and are dictated largely by soil type. Further references to mechanisation investigations peculiar to each crop appear under crop headings.

(i) LAND PREPARATION BY MACHINERY.

399. (a) *Coastal Clays*.—Lack of staff has held up work on the removal of jungle by mechanical means but it was possible to conduct an investigation on the removal of standing rubber, which was described in the October, 1949, issue of the *Malayan Agricultural Journal*. In the same issue of the Journal a description is given of methods employed at the Federal Experiment Station, Port Swettenham, in the formation of beds and their subsequent fracturing by means of chiselling in order to increase aeration and to form a "workable" soil of as great a depth as possible.

400. (b) *Peat Soils*.—The peat soils in Malaya are characterised by the large numbers of fallen timbers both on and in the soil. Preliminary investigations at Chenderong Balai in South Perak, have shown that, both by hand and mechanical means, the removal of these timbers is likely to be very expensive. Unless it is done effectively, mechanical cultivation later will be impossible and it appears likely that subsequent cultivations will be confined to hand operations for a considerable number of years.

401. (c) *Inland Soils*.—Mechanical operations in these soils should be designed largely with a view to soil conservation. Investigations now in progress at the Federal Experiment Station, Serdang, show that heavy secondary jungle can be removed mechanically and that contour terraces can be constructed. Attempts are being made to discover the steepest slope on which such terraces may be economically constructed by mechanical means.

(ii) CULTIVATION OF STANDING CROPS.

402. Two inter-row cultivations on coconut experiments, laid down at the Federal Experiment Station, Port Swettenham, have been described in the October, 1949, number of the *Malayan Agricultural Journal*. Proposals have been put forward to lay down similar experiments on estates.

26.—SOILS INVESTIGATIONS.

403. Reference has been made, under crop heads, to specific soil investigations in relation to the growth of crops on them. This section deals with investigations into soils *per se*.

(i) PEAT SOILS.

404. During the year a considerable amount of investigation into the chemical composition of Malayan peat was carried out. The purpose of this was to find out how Malayan peats compare with those found in other countries and also to see if there is any difference in chemical composition between the peats from the various areas in Malaya.

405. For the investigation a method of proximate analysis has been adopted similar to that described by Ashworth (*Journal of Agricultural Science*, XXXII, 1942, 349). Briefly the method consists of extracting the peat with hot water to remove the soluble salts and polysaccharides, then the peat is treated with chloroform to extract the fats, fatty acids, resins and waxes and finally with alcohol to extract the tannins, phlobaphenes and colouring matter. The residue is boiled with 2 per cent. hydrochloric acid to give an estimate of the easily hydrolysable matter and finally with 80 per cent. sulphuric acid. The reducing sugars formed are estimated in each case and the results reported as hemicellulose and cellulose. The insoluble residue minus the "protein" nitrogen is described for convenience as lignin.

406. The Malayan peats so far examined have been found to consist of woody or forest peat laid down under swamp conditions, and analysis has shown them to resemble in some respects the oligotrophic peats of Europe and America. They generally contain fairly high chloroform and alcohol-soluble fractions, although the amounts vary from place to place and from sample to sample.

407. The cellulose values are considerably higher than the values given for low-land peats of other countries, while the low ash content and low proportion of calcium in the ash all point to the poverty of the Malayan peats and their relationship to the high moor peats of temperate countries.

408. Generally the profile in the deeper peat areas consist of 3 to 6 ins. of black amorphous material on top and the red-brown woody peat underneath which extends throughout the depth of the profile. In certain cases the timber is in fairly good state of preservation and provisional identification has been possible.

(ii) ARSENIC IN MALAYAN SOILS.

409. Reference has previously been made to the high concentration of arsenic occurring in certain of the soils at the Federal Experiment Station, Serdang, and during the year, a survey was carried out to determine how widespread was the occurrence of arsenic and its concentration in the various fields. The survey showed that arsenic occurred to some extent in all the fields but generally in such low concentration as would not be regarded as harmful to vegetation.

410. A surprising result, however, was the high arsenic content of samples of lateritic soil taken in the rubber plantation adjoining the entrance to the Station, where values of the order of 150 p.p.m. As_2O_3 were obtained. Usually the presence of arsenic in soils has been regarded as a consequence of arsenical pyrites associated with tin bearing ores, but its presence in lateritic soils is difficult to explain. As a result of this finding, several soil samples from other lateritic areas were analysed and in each case were found to contain fairly high concentrations.

411. A small area in one of the fields on the Station, where an arsenic concentration of the order of 450-500 p.p.m. As_2O_3 were known to occur, was examined and samples taken at intervals of a few yards. Wide variations in the arsenic content were found but the highest concentration was found to occur in

conjunction with a slate blue-grey layer found 6 to 9 ins. below the surface. Where the covering of grass was thinnest or non-existent it was found that the amount of "available" As_2O_3 as determined by extraction with $\frac{N}{100} \text{H}_2\text{SO}_4$ was highest.

(iii) ANALYTICAL METHODS IN SOILS INVESTIGATIONS.

412. As noted in the section on padi soils, a start has been made on the use of the Neubauer method for determining "available" phosphate and potash. Instead of the rye seedlings used in the original method by Neubauer, padi seedlings were used and these have been successful, germination being in most cases over 98 per cent. Owing to the shortage of apparatus, the trials have been, of necessity, on a small scale, but quite large differences occur in the growth of the plants from one soil to another. There does not appear to be any correlation, however, between the amount of phosphate in the ash and the growth of the plant. In the case of potash, the duplicates do not show very close agreement but there are indications that the good padi soils have a higher available potash content.

(iv) SOIL SURVEYS.

413. (a) *Squatter Resettlement Areas*.—During the year three areas, where it was proposed to resettle squatters, were surveyed. The first of these areas situated near Pantai Remis in the Dindings consisted of an area covered with peat up to a depth of 4 ft.

414. The second area, at Mawai near Kota Tinggi in Johore, was found to cover the junction of the granite and quartzite soils in that area and was regarded as being reasonably suitable for growing vegetables, provided erosion control measures were carried out.

415. The other area to be inspected was near Bahau in Negri Sembilan, where the jungle had been felled and the land cropped during the Japanese occupation. The soil was a poor sandy quartzite which had suffered to a considerable extent through wash, and it was considered that the difficulty of establishing crops and building up the fertility would be so great that any settlement project would have little chance of success.

416. (b) *Federal Experiment Station, Serdang*.—In connection with a set of proposed experiments for the maintenance of soil fertility a detailed survey of Fields 11 to 15 at the Federal Experiment Station, Serdang, was carried out. On the basis of colour, texture and drainage characteristics, six soil types were recognised and plotted on a large-scale map. The soils became progressively darker in colour from the higher to the lower ground. The colour varied from a red-brown loam to a blue-black loam. The mapping showed that it would scarcely be possible to set up an experiment requiring a substantial acreage on any one soil type.

27.—MISCELLANEOUS ENTOMOLOGICAL INVESTIGATIONS.

417. Samples of insecticides continue to be sent both from local and overseas sources, and to make detailed tests and reports on these would call for an increase in staff.

418. Reports on insecticides tested against specific pests of padi, cocoa, oil palm, maize and cloves appear under the respective crop headings.

419. Agrocide 3 dust at the rate of 1 oz. to 4 sq. yds. in the laboratory gave better control of *Apogonia cribricollis* Burm. on the soil than when dusted on canna flowers. Against the red ant, *Oecophylla smaragdina* L., it was less effective than chlorinated camphene (Toxaphene) when applied by a blower to nests.

420. D. 034 and 5 per cent. DDT gave good control in rice godowns against *Calandra oryzae* L., *Corcyra cephalonica* St. and other stored product pests.

421. Reports available during the first half of the year showed the hazard attendant on using the new systemic insecticides which are absorbed by the plant. Small-scale tests were made on beds of canna flowers which are very attractive to the chafer, *Apogonia cribricollis* Burm. a pest of cocoa leaves. A trial with 1 part in 4,000 parts of water of the systemic insecticide E. 605 (Parathion or Thiophos 3422) and also with TEPP (Tetra-ethyl-pyrophosphate) having failed, spraying was done with the latter at 1 part in 1,000 parts of water and 1 in 500. Owing largely to the successive opening of the flowers from their protective sheaths, there was no noticeable decrease in damage to the new blossoms at either concentration.

422. Chlorinated camphene (Toxaphene) gave good results against the keringga ant *Oecophylla smaragdina* L. when dusted experimentally on the nests at 20 per cent. strength and applied in a field scale at 10 per cent. Laboratory dusting tests against the armyworm *Spodoptera mauritia* Boisd. were good, but it is controlled effectively though more slowly with 5 per cent. DDT dust.

423. Chlordane spray at 3 grms. per litre against the armyworm *Spodoptera mauritia* Boisd. gave a lower kill on the first day than either chlorinated camphene or a proprietary DDT spray. but 100 per cent. mortality was obtained by all three in two days.

424. Examples of insects in stored products other than grain were *Etiella* sp. in seeds of groundnuts, *Ephestia* caterpillars in chocolates, *Lasioderma serricorne* F., cigarette beetle in cigarettes on sale and the following beetles in nutmegs: *Araecerus fasciculatus* de Geer., *Oryzaephilus surinamensis* L., *Tribolium castaneum* Hbst., *Carpophilus dimidiatus* F., *Cathorama herbarium* Gorh., and *Laemophlaeus* sp. The carpet beetle *Anthrenus vorax* Waterh. was a pest from bristles of brushes in Singapore.

425. Insect pests recorded in timber were as follows:

426. *Beetles*.—Window-frames of merbau wood (*Intsia palembanika*) in a new building were found to be bored by the powder-post beetle *Minthea rugicollis* F. for which pentachlorophenol paint was recommended. This beetle is well known locally as a pest of stored derris roots.

427. *Termites*.—The following species caused damage: *Coptotermes curvignathus* Holm. in power cables (Singapore), *C. parvulus* Holm. and *C. travians* Hav. from a ship (Singapore) and the former also in old oil palms (Selangor), *Microtermes pallidus* Hav. and *Hamitermes* (*Globitermes*) *sulphureus* Hav. from buildings. The common mound-building *Macrotermes gilvus* Hag. caused damage to turf on golf links and bowling green. The records of *C. parvulus* are interesting as this insect has not previously been recorded elsewhere than Bombay and Java.

428. Identifications were kindly made by Mr. F. J. Gay of the Division of Entomology, Commonwealth of Australia, Canberra.

429. With the appointment of an Entomologist at the Forest Research Institute, Kepong, timber pests will soon cease to be dealt with by the Department of Agriculture.

28.—MISCELLANEOUS ENTOMOLOGICAL AND PHYTOPATHOLOGICAL MATTERS.

(i) EXAMINATIONS OF PLANTING MATERIAL.

430. This comprised mixed seeds for dispatch to Costa Rica and Tanganyika, padi for Portugal, Italy, Gold Coast, Costa Rica, China, Argentina and Uganda, and soyabeans for the United States of America. For certain of these consignments, fumigation with chloropicrin was carried out.

431. Celery from Western Australia forwarded from Singapore was found on arrival to be attacked by Aphids. Examination of growing plants included limes, pomelo, durian, soursop and carambola for dispatch to Labuan, North Borneo.

(ii) IDENTIFICATION OF FUNGI.

432. During the year 32 cultures and 108 herbarium specimens of fungi were sent to the Commonwealth Mycological Institute for naming while identifications of nine cultures and 133 herbarium specimens were received from that Institute. Many of the fungi mentioned in this report were identified by the staff of the Commonwealth Mycological Institute to whom thanks are due.

(iii) PLANT IMPORTATION REGULATIONS.

433. The revision of the Plant Importation Regulations for the Federation of Malaya was undertaken by the Senior Plant Pathologist and a draft of the proposed new regulations completed and forwarded to Government for consideration.

(iv) IDENTIFICATION OF INSECTS.

434. The Commonwealth Institute of Entomology identified 166 species of which 4 were new to science and 10 new to, or unrepresented in, the British Museum (Natural History) collection. Besides this indispensable service provided by the Institute, various questions of nomenclature were answered including proof that one of the local padi stem-borers is a *Proceras* and not a *Diatraea* which is a South American genus. Similarly the local maize stalk-borer, long referred to as a *Pyrausta salentialis* Snell., was shown to be more closely related to *P. nubilalis* Hb., the well-known European corn-borer of North America.

435. Two Hymenopterous parasites of padi and tea pests were kindly identified through the offices of Mr. C. Muesebeck of the U.S. Bureau of Entomology and Plant Quarantine, Washington. Termites were identified through the courtesy of Mr. F. J. Gay of Canberra and Scolytid borers by the Entomologist, Forest Research Institute, Kepong.

(v) INSECT COLLECTION.

436. The stainless steel entomological pins, ordered in 1946, have not yet arrived; so-called stainless steel pins consisting of ordinary steel with a japanned coating are useless for permanent collections in the wet tropics. The arrival of store-boxes allowed for an expansion of the collection of economic insects.

(vi) VISITING ENTOMOLOGISTS.

437. Mr. N. L. H. Krauss, Entomologist, Board of Agriculture and Forestry, Hawaii, left the Federation in April for Singapore after eleven months spent in collecting, breeding and forwarding four Hymenopterous parasites of the Oriental fruit fly, *Dacus dorsalis* Hend. to Hawaii. This insect is probably conspecific with the local *D. ferrugineus* Hend. During the first three months of the year, nearly 150,000 fly pupae were sent by air to Honolulu where the Braconid *Opius persulcatus* Silv. appears to be catching up on *O. longicaudatus* (Ashm.) which was the most abundant parasite sent in 1948. Besides *Opius* sp. near *incisi* Silv., dispatches were also made of the Eulophid *Syntomosphyrum indicum* Silv. Many new records were made by Mr. Krauss in his collection at various localities and these he kindly made available to the Division.

438. The Hymenopterous parasites of the citrus black fly, *Aleurocanthus woglumi* Ashm. sent and taken by Mr. H. D. Smith of the U.S. Department of Agriculture, reached Mexico in good condition. These minute Eulophid parasites were *Prospaltella divergens* Silv., *P. smithi* Silv., and *Eretmocerus serius* Silv.

439. Professor P. Vayssiere of the French Colonial Scientific Research Council visited the Division several times in connection with caterpillar pests of the oil palm which he was investigating for a local company.

440. Dr. J. van der Vecht, Director of the Institute for Plant Diseases, Buitenzorg, Java, paid a visit to the Division and discussed insect control in Indonesia.

(vii) REGIONAL PHYTOSANITARY CONFERENCE.

441. This was held in the office of the Commissioner-General in Singapore in April to discuss the setting up of a Phytosanitary Convention for South East Asia. It was attended by delegates from the United Kingdom, Federation of Malaya, Singapore, India, Ceylon, Indo-China, the Netherlands East Indies and Fiji, with observers for Australia, United States of America and United Nations (Food and Agriculture) Organisation. The Federation of Malaya delegation included the Senior Plant Pathologist (representing also Hongkong and Sarawak) and the Senior Entomologist while the Entomologist represented Fiji.

29.—LIVESTOCK.

(A) Pigs.

442. Selection amongst the local Chinese pigs was conducted at the Federal Experiment Station, Serdang. Several of the types isolated show promise of giving results much superior to those obtained with the average Chinese type.

(B) *Goats.*

443. Up-grading of local goats with Toggenburg and Saanen is being concentrated at the Federal Experiment Station, Serdang, and with British Alpine at Malacca. The policy is to keep the imported does at Cameron Highlands and the bucks in the plains for use on herds of local goats, the does at Cameron Highlands to be artificially inseminated.

(C) *Poultry.*

444. From the results of investigations up to the present time Rhode Island Reds appear to be the best dual purpose birds for Malayan conditions, and flocks are maintained on many State and Settlement Agricultural Stations to provide cockerels for distribution to the public. New strains were imported from South Africa and Australia during 1949 in order to reduce any tendency towards inbreeding. A comprehensive experiment, conducted at Cameron Highlands to test various strains of Rhode Island Reds, made it clear that the introduction of new blood improved the fertility of eggs from birds of local origin. A series of tests of Rhode Island Reds and local birds on semi-free range and in kampong conditions has been planned and will start early in 1950. In addition, Australorps are being tested against Rhode Island Reds on State stations in Selangor.

B.—EXTENSION AND ADVISORY WORK.

445. This work is undertaken by officers of both the Research and Field Branches, the former as Federal officers chiefly advising directly to growers or other commercial interests or other Departments or, where expedient and desirable, through State/Settlement Agricultural Officers, the latter carrying out extension and advisory work directly in their respective States/Settlements. All officers are responsible for advising the Director of Agriculture who, in turn, advises the Federal Government and, from time to time, the Governments of States/Settlements. State/Settlement Agricultural Officers are responsible for advising their respective State/Settlement Governments.

446. Extension and advisory work for the year of both the Field and Research Branches are reported on here.

1.—FIELD BRANCH.

(A).—*Crops.*

(i) PADI.

447. (a) *Improvements to Padi Areas.*—A total of \$238,771 was spent from Federal funds in 1949 on work of this nature. Since the former Short-term Food Production Organisation was absorbed by the Department on 1st March, 1947, its work has been largely directed to (a) investigations into the mechanical cultivation of both wet and dry padi and (b) the increasing of rice production by improvements of drainage and irrigation as regards existing padi areas and the bringing into cultivation of new areas. The sum mentioned above has been devoted to the second of these objects. The work

has been carried out in close co-operation with the Drainage and Irrigation Department and the following table shows the progress of the work from its inception up to the end of 1949:

IMPROVEMENTS TO PADI AREAS.

For period 1st March, 1947, to 31st December, 1949.

	Acre.
A.—Acreage of new land provided with irrigation and/or drainage works	45,869
B.—Acreage of existing Padi land which has been improved.. .. .	288,136
Total ..	334,005

Total expenditure incurred on A and B .. \$ 2,274,293

448. The provision of access roads and other facilities to padi areas have also been financed to some extent from this vote.

449. (b) *Subsidies to Padi Planters.*—The sum of \$30,384 was spent from Federal funds in 1949 and was devoted to the settlement of colonists in newly-opened padi areas.

(c) *Padi Seed Distribution.*

450. (i) *Relief Measures.*—A total of \$12,063 was spent from Federal funds in 1949 in respect of the supply of seed to areas requiring same. Funds expended under this head are normally recoverable but 19,000 gantangs of seed were distributed free of charge at a cost of \$12,000 as a relief measure to cultivators whose crops were a total loss as the result of drought which seriously affected the 1948/49 season crop in Kedah.

451. (ii) *Improved Strains.*—Practically the whole of the pre-war work on improved strains was lost during the war and the Department was thus forced to commence work anew in 1946. The selection and proving of an improved strain takes at least seven years to carry through; thus it will be 1953 before any results of the work now in progress can be available for extension purposes.

(ii) RUBBER.

452. (a) *Small-Holders Advisory Service.*—Instructors and Demonstrators of the Small-holders Advisory Service of the Rubber Research Institute of Malaya to the number of 83 continued to operate throughout the country under the supervision of State/Settlement Agricultural Officers. Their activities included the demonstration and encouragement of the use of approved planting material, the supervision of demonstration replanting plots, the erection of smoke-houses and their operation, the supervision of trial rubber grading schemes and the demonstration of methods of controlling pests and diseases, preventing erosion and the use of fertilisers. A further activity has achieved prominence in some areas of late; the organising of schemes of latex collection and centralised processing. The Service is now a well-established one and has the confidence of the small grower of rubber. The liaison between the Department and the Rubber Research Institute in matters affecting the work of the Service has continued to be close and effective.

453. (b) *Supply of Approved Planting Material*.—The Department, in conjunction with the Rubber Research Institute, has taken steps to meet the demand for approved planting material for small-holders engaged in replanting and new planting. The sum of \$124,000 was made available in 1948 from the Malayan Rubber Fund for this purpose and on 1st August, 1949, a grant totalling \$1,043,875 was made available from the Colonial Development and Welfare Fund as Scheme No. D. 1176. This scheme is being administered by the Department and will run for five years. It is sub-divided as follows:

- (1) The renovation of 60 acres of existing budwood multiplication nurseries on Agricultural Stations throughout the country together with the establishment and maintenance of 90 acres of new nurseries of which 75 acres will be laid down at the Rubber Research Institute Experiment Station at Sungei Buloh and the remainder on Agricultural Stations.
- (2) The establishment of $62\frac{1}{2}$ acres of clonal seedling nurseries annually; $37\frac{1}{2}$ acres by the Rubber Research Institute and 25 acres by the Department.
- (3) The training of 100 village youths annually, at Sungei Buloh, in general rubber work.
- (4) The establishment of 200 acres of clonal seed garden at Sungei Buloh on the hedge-planting system; the area between the hedges being planted with budwood or clonal seed nursery or utilised for experiments on two-crop cultivation, e.g., rubber and cocoa.

454. During 1949, owing to the comparatively small extent of replanting and new planting by smallholders, the supply of approved planting material greatly exceeded the demand. There was increasing interest in new planting, however, towards the end of the year and a very definite demand for clonal seedling stumps as opposed to budwood for planting purposes. This demand for clonal seedling stumps at the expense of budwood may render it necessary to revise the scheme in the near future.

455. Totals of 18,147 yards of budwood and 163,956 clonal seedling stumps were distributed at a nominal charge to small-holders during 1949, from the nurseries maintained by the Rubber Research Institute and the Department.

456. (c) *New Planting*.—An area of 865 acres in the Malay Reservation at Kalumpang, Ulu Selangor, has been divided into 5-acre blocks, individually owned, for new planting. The work is proceeding on a communal basis, the first step being the establishment of clonal seedling nurseries together with seedling nurseries for budding and transplanting as budded stumps. The planting material was supplied by the Department and the Rubber Research Institute in co-operation and paid labour was used to prepare the nurseries, payment being made from a common fund to which individual owners contributed an agreed sum. The scheme appears to be working satisfactorily.

457. (d) *Latex Collection and Centralised Processing*.—A development of considerable interest during the year has been the establishment in three States of latex collection and

processing centres. This new system of collecting and treating smallholding latex has the dual effect of improving the quality of the rubber produced by smallholders and of increasing the value to the smallholder of his crop. The main development has been in Kedah where considerable assistance has been rendered by Rubber Instructors and officers of the Department in fostering schemes of this nature. There has been a widespread response and a desire to establish and operate centres in many parts of the State, but only a limited number are being allowed at present, prior to greater experience of their working being accumulated. The centres are not at present co-operatively run; for the most part they are operated by Malays with business instincts, but there is little doubt that they represent a valuable development, more especially in view of the imperative need for this country to improve its export standards, as far as natural rubber is concerned, as a counter to the very serious threat of the synthetic product.

(iii) COCONUTS.

458. Improvements in the quality of copra produced by the smallholder is largely dependent on the price difference between the wet and dry product and only in the east coast States is this reflected at present, in the erection and use of the improved types of smallholders' kiln, designed by the Department.

(iv) FRUIT TREES.

459. Considerable progress was made during the year in the providing for sale of improved planting material of fruit trees. Budwood nurseries at Agricultural Stations throughout the country have further increased their stocks of clonal material and the out-turn of budded and marcotted plants is progressively being raised. A total of over 1,700 budded and marcotted plants of a wide range of varieties were sold or otherwise distributed during the year. Nevertheless, the demand for planting material of this nature still exceeds the supply.

(v) VEGETABLES.

460. Trials on an extensive scale at Cameron Highlands of a considerable number of imported varieties of hill vegetables resulted in markedly improved yields as compared with the varieties normally grown locally. As the result of this, and at the request of the growers themselves, steps were taken to import in bulk, for distribution throughout the Highlands, seed of the most promising overseas varieties.

(B).—*Livestock.*

(i) PIGS.

461. The Middle White-Chinese cross has become popular over a number of years in various parts of the country, although the work was, like many departmental activities, interrupted by the war. The main focus of interest now lies in Penang and Province Wellesley where there is a keen demand for Middle White stock and where over 100 boars of this breed are now in use. Elsewhere the instability of the pig-rearing industry, owing to the high and frequently fluctuating prices of feeding-stuffs, has militated against progress along similar lines. Pure-bred Middle White young boars and sows were bred at the Tanah Rata Station, Cameron Highlands, and distributed to Chinese commercial pig-rearing centres.

(C).—Agricultural and Padi Stations.

462. In addition to their being the centres for much of the field investigation work carried out by the Department, the Agricultural Stations throughout the country serve as centres for the distribution of planting material of a large variety of crops. The great bulk of the material so distributed during the year consisted of budwood and clonal seedling stumps of rubber and budded plants of a variety of fruits. There was also a big demand for planting material of cocoa, Manila hemp and pepper which could only be met in part. The Department is almost the sole supplier, at present, of planting material of these crops.

(D).—School Gardens.

463. The training of vernacular school pupils in the rudiments of agriculture and nature study through the medium of school gardens has long been a feature of the syllabus of these schools. The Department has continued to advise on the working of these school gardens and to supply planting material and other direct assistance needed by them.

(E).—Agricultural Shows.

464. Seventeen District and Mukim shows were held throughout the country during the year. These shows offer a useful opportunity for extension work, through the medium of Departmental exhibits, demonstrations of technique, propaganda, etc., applicable to the particular area covered by the show.

(F).—Pest and Disease Control.

465. Rats and wild pig continued to be the major pests affecting agricultural crops, in particular the foodcrops. Rat control has been considerably aided by the adoption of zinc phosphide for control measures. This poison has proved highly effective in many parts of the country. The control of wild pigs has been rendered more difficult on account of the hunting restrictions imposed by the Emergency; many of the shot-guns loaned by the Department to cultivators throughout the country have been taken over by the Police. Poisoning is a less effective and less popular method of control and trapping is not extensively practised.

466. Mouldy rot disease of rubber continues to be endemic in many areas and treatment still leaves something to be desired although considerably more effective than in the past.

(G).—Advisory Work.

467. The advisory work of State/Settlement Agricultural Officers and their staffs is manifold in its aspects. They advise the State/Settlement Administrations on all agricultural matters and they are the authorities to whom both estates and smallholders turn when seeking advice thereon. The tendency on the part of estates to spread their commercial risks by planting crops alternative to rubber has led to considerably increased contacts between managers and officers of the Department and this is further being enhanced by the inauguration of experiments carried out in co-operation with estates. The liaison between the Department and smallholders through the medium of the district agricultural staff continues to increase as the work of the Department for the smallholder becomes increasingly appreciated by the latter.

2.—RESEARCH BRANCH.

(A).—Botanical.

(i) SEED DISTRIBUTION OF IMPROVED OIL PALM VARIETIES.

468. Moderate quantities of seed of "dumpy" × tall × "dumpy" backcrossed pedigree seed surplus to Department requirements were supplied to estates.

(ii) EXTENSION OF LEGUME GROUND COVERS.

469. The experimental establishment of Ladino White Clover (*Trifolium repens* var. Ladino) has been very successful in the tea fields at the Agricultural Station, Cameron Highlands.

(iii) SEED GERMINATION TESTS.

470. Germination tests of samples of seeds were made for Departmental officers.

(iv) PLANT IDENTIFICATION AND PROVISION OF PLANT SPECIMENS.

471. As usual, identifications of plant specimens have been made for other Research Branch officers, State Agricultural Officers, Estate Managers and other members of the public.

472. Specimens were provided to the Education Department for the School Certificate Examinations.

(v) NUTRITION SURVEY.

473. Samples of a representative series of Malayan varieties of padi were collected and supplied to the Senior Biochemist, Institute for Medical Research, for chemical analyses. Information relating to soil conditions of sites where these were grown was also supplied, and results of analyses indicate that there is some degree of positive correlation between soil types and mineral content of grain. A further series of samples is being collected to continue this investigation.

(vi) QUALITY AND NATURE OF MILLED RICE.

474. Identifications and reports on quality of milled rice have been made for other Departments.

(B).—Chemistry.

(i) OIL PALMS—ADVISORY VISITS.

475. As in the past, contact with oil palm estates and the Federal Experiment Station, Serdang, has been maintained. The Senior Chemist made a number of visits to estates, principally in connection with problems concerned with the manufacture of oil or the processing of kernels.

476. The more efficient harvesting, the more prompt treatment of fruits and the better treatment of the oil owing to improved mechanical condition of the factories have resulted in a satisfactory improvement of the quality of commercial Malayan oil.

(ii) ROUTINE ANALYSES OF COMMERCIAL AND OTHER SAMPLES.

477. The total number of commercial and other routine samples received for analysis during the year was 1,062, and the fees collected amounted to \$3,227.25. These samples included those of oils and fats, feeding stuffs, fertilizers and manures, insecticides and fungicides, water, jelutong, resins and other forest products.

(iii) EXAMINATION OF FEEDING STUFFS.

478. Among the many feeding stuffs received for examination were sweet potatoes, Irish potatoes, different varieties of tapioca, tubers of *Dioscorea bulbifera*, foliage of *Leucaena glauca*, rhubarb, Ladino clover, sago and wheat bran.

(iv) MISCELLANEOUS ADVISORY WORK.

479. Advisory work dealt with fertilizers, feeding stuffs, coconut oil and palm oil machinery, and bulk shipment of palm oil.

(C).—Entomological.

(i) STORED PRODUCTS.

480. At the request of the Supplies Department, visits were paid in July and August to the main rice godowns in all the States and Settlements except Pahang. The immediate application of DDT dust was recommended, as, except for Johore Bahru—where D. 034 (Gammexane) had been in use for some time—no regular insecticidal disinfestation was practised. Later it was found more convenient to follow what was done in Singapore and have all stocks dusted with D. 034.

481. The most serious pests were the rice weevil, *Calandra oryzae* L. and the rice moth *Corcyra cephalonica* St. Less important were—lesser grain-borer, *Rhizopertha dominica* F. rust-red flour beetle, *Tribolium castaneum* Hbst., saw-toothed grain beetle, *Oryzaephilus surinamensis* (L.) and the moth, *Ephestia cautella* Walk.

482. An illustrated pamphlet written in popular language was produced and circulated to the Supplies Department for issue to their staff, rice agents and mill managers. Emphasis was laid on the need for general godown cleanliness and ventilation, use of only sound sacks, avoidance of reinfestation of re-conditioned “ropy” rice with rice moth caterpillars and the risk of storing bran, flour and rice sweepings next to sound, bagged rice.

483. It was found from laboratory tests that only about 12 per cent. of weevils (*Calandra oryzae*) dying after dusting with 5 per cent. DDT had their hind wings exposed beyond their wingcases; with D. 034 this figure was over 80 per cent. This is of some practical value in assessing whether a given bay in a godown has been treated with DDT or D. 034.

(ii) ENTOMOLOGICAL QUERIES.

484. Besides the normal routine identifications of economic insects forwarded for report and control, questions were referred on rats, mites, spiders, and crabs. A questionnaire on the giant snail (*Achatina fulica* Fer.) from New Guinea was answered.

(iii) DEMONSTRATION OF FOG APPLICATOR.

485. A demonstration was attended in Kuala Lumpur of the Todd Insecticidal Fog Applicator (T.I.F.A.) which is a machine producing a dense fog evolved from petroleum oil and water containing the chosen insecticides.

(D).—*Soils Chemistry.*

(i) SOILS ANALYSES IN RELATION TO PLANT GROWTH.

486. Soil samples were received and reports issued on oil palm replanting, cocoa planting, an area where bronzing of oil palms was taking place, basket soil where die-back of cocoa plants occurred, from the forest nursery, Forest Research Institute, Kepong, and from the Paya Besar Irrigation Area, Kuantan.

487. A series of soil samples has been received from a reclaimed area at Bukit Tambun, Province Wellesley, where Chinese settlers were having difficulty in growing vegetables. It was found that the salt concentration was still high and that this was probably the main factor in the poor results obtained by the farmers.

488. A water sample from a poor yielding sawah at Kuala Pilah has been examined for arsenic and found to contain as much as 6 p.p.m.

(ii) SOILS ANALYSES AND ADVISORY WORK FOR THE FOREST RESEARCH INSTITUTE.

489. A number of soil samples were received from the Forest Research Institute in connection with an investigation into the regeneration of exploited land. Organic matter determinations were carried out on these samples but so far no correlation has been found between the amount of organic matter and the treatment which the soil has undergone.

(E).—*Canning Research Station.*

(i) ADVISORY VISITS TO PINEAPPLE CANNERIES.

490. Six registered canneries, three in Singapore, two in Johore and one in Selangor, were in operation during the year. Regular visits were made to them and they were given advice on factory practice with a view to raising and maintaining the quality of the packs to the standards required. It was impressed on them that some of the most serious and commonly noticed faults, such as low vacuum, irregular or lack of headspace in the can and irregular cutting could be easily rectified by closer attention to detail and factory supervision.

(ii) PINEAPPLE SAMPLING AND SAMPLING TECHNIQUES.

491. Samples week by week were taken from the canneries, examined at the Canning Research Station and the report forwarded to the cannery from where the respective samples were taken.

492. Much work was done perfecting a more exact system of analysis and marking samples, originally worked out by the Adviser, Malayan Pineapple Industry. It is proposed that all canners will set up their own testing laboratories and that after training at the Canning Research Station, personnel of the canneries will be able to do their own check analysis.

(c) *Agricultural Education.*

1.—THE COLLEGE OF AGRICULTURE, MALAYA.

(i) ADVISORY COUNCIL.

493. There were no changes in the membership of the Advisory Council. The Council met once during the year on December 2nd.

(ii) COLLEGE YEAR.

494. The year was divided into three terms, as under:

3rd term, 1948/49, session—January 12th to April 12th.

1st term, 1949/50, session—June 7th to September 3rd.

2nd term, 1949/50, session—September 27th to December 21st.

(iii) REGISTER OF STUDENTS.

495. On completion of the academic year 1948/49 in April, 1949, the last group of Diploma Course students graduated, whose period of training was two years. Together with these men were the One Year Course students of the 1948/49 academic year. Going forward to their second year were the first group of men who had completed the first year of training under the new provision of three years' training for the Diploma Course.

496. In June, 1949, the new session opened with categories of students composed as follows:

Category.	Malays.	Indians.	Chinese.	Others.	Total.
DIPLOMA COURSE.					
SECOND YEAR STUDENTS.					
Federal Scholars	4	1	6	—	11
Singapore Scholars	—	—	1	—	1
Borneo Students in Training ..	—	—	1	—	1
Sarawak Students in Training ..	—	—	1	—	1
	4	1	9	—	14
FIRST YEAR STUDENTS.					
Federal Scholars	5	1	10	—	16
Private Students, Federal ..	—	—	1	—	1
Singapore Scholars	—	—	1	—	1
Private Students, Singapore ..	—	—	2	—	2
	5	1	14	—	20
ONE YEAR COURSE STUDENTS.					
Federal Scholars	11	—	—	—	11
Private Students, Federal ..	3	—	—	—	3
Malay Agricultural Subordinates, Kedah ..	3	—	—	—	3
Penghulus/Assistant Penghulus/Ketua	20	—	—	—	20
	37	—	—	—	37
TOTALS ..	46	2	23	—	71

497. Of the above, one private student of the first year Diploma Course has been awarded a Federal Scholarship on this year's allocation, the scholarship to commence from his second

year, i.e., in June, 1950. A private student of the One Year Course withdrew from the College at the end of the second term for family reasons.

(iv) MAJOR AND MINOR AGRICULTURAL SCHOLARSHIPS.

498. The Federal Government offered 20 Major and 11 Minor Scholarships in 1949. Following the procedure initiated in 1947 the names of the qualified applicants were sent to the State and Settlement Selection Committees for interview; their recommendations were submitted to the Director of Agriculture for final approval of the selected candidates. On the assumption that all States and Settlements would provide qualified candidates, the total of 20 major scholarships had been allocated on the basis of two each to the eight large States and Penang and Province Wellesley, and one each to Perlis and Malacca. The minor scholarships were allocated one to each State and Settlement. The minor scholarships were distributed as anticipated, and 11 scholarships were granted. For the major scholarships there were finally only 16 qualified applicants to fill the 20 places offered. The other four suitably qualified applicants withdrew at the last, to accept salaried posts offered under the Emergency expansion in certain Government Departments.

(v) TRAINING.

499. The training in the Diploma Course followed the same lines in general as in the previous year. The first two years of instruction in the Diploma Course are intended to provide a training in general Malayan Agriculture. The third year is intended to give further training, and particularly practical experience in special aspects of the science of Agriculture.

500. In the One Year Course the number of Federal Scholarships had been reduced to 11. This was done partly because the scope for employment of this class of student is limited, and also because it was desired to put into effect a scheme for admitting Penghulus and Assistant Penghulus and Malay Vernacular School Teachers into the College to take the One Year Course. Nineteen Penghulus and Assistant Penghulus, one Ketua, and three Malay Agricultural Subordinates were enrolled and entered the One Year Course.

501. The hours of lectures and field work for the three-year Diploma Course have been altered to bring the time-table more into line with University procedure, and further afternoon practical courses in the laboratories were commenced.

502. In co-operation with the Agricultural Officer i/c Federal Experiment Station, Serdang, field work was planned so that the students received the widest possible experience in all the important crops, in all stages from field to factory. In addition, they actively assisted in field experiments and such work as laying contour lines and anti-erosion measures.

503. The second year and the One Year Course students each spent a week camping at the Coconut Experiment Station, Port Swettenham, undergoing an intensive course in coconut

planting. Later, the same students devoted two weeks to an intensive rubber course at the College; the staff was assisted by four Asiatic Rubber Instructors from the Rubber Research Institute. Instructional tours were organised to places of agricultural interest and local industries, including a visit to Fraser's Hill and the Government Farm, Fraser's Hill, Pahang.

(vi) HEALTH AND RECREATION.

504. The health of the students and labour force was good. There were no cases of serious illness.

505. The Students' Union and Council functioned smoothly throughout the year. There have been no occasions when the staff was called to intervene on matters of discipline or "internal government". Elected committees organised all the extra-curricular activities, and the co-operative show has been operated successfully entirely by the students.

506. The sports facilities include badminton, hockey, football, basketball and tennis. The grounds were well maintained in spite of some difficulties due to shortage of equipment. On a number of occasions our grounds were loaned to the Army Units stationed at Sungei Besi who have shown keen appreciation of this facility.

(vii) CATERING.

507. Catering has continued to be a staff responsibility, and although this work adds considerably to the duties of the staff concerned, it is generally thought to be much more satisfactory than the previous system of providing meals by contract. The cost of full board was between \$1.30 and \$1.35 per student-day, and the quality of the food provided has been very favourably commented on by both the students themselves and visitors from other institutions.

(viii) REVENUE AND EXPENDITURE.

508. The cost of maintaining the College in 1949, not including revotes carried to 1950, was \$92,328.51 accounted for as follows:

(i) Staff Emoluments	\$36,654 33
(ii) Other Charges, Annually Recurrent ..	27,030 16
(iii) Other Charges, Special Expenditure ..	28,644 02*

509. Revenue amounted to \$7,662.35, of which \$6,698.32 was derived from tuition fees, and \$964.03 from rent on Government quarters.

(ix) PRESENT EMPLOYMENT POSITION OF COLLEGE GRADUATES.

510. In the inclusive period 1931-49 a total of 506 students completed one or other of the respective courses of training at the College. Distribution of these by nationality is as follows:

	Melays.	Chinese.	Indians.	Others.	Total.
Diploma Course ..	98	106	26	9	239
One Year Course ..	249	12	—	6	267
Total ..	347	118	26	15	506

* Includes provision of Agricultural Scholarships, \$26,272.82.

511. Of this total of 506, by the end of the year under report, 421 had been traced with the following occupational status:

	One Year Course Students.	Diploma Course Students.	Totals.
Departments of Agriculture . .	116* . .	69† . .	185
Other Government Departments . .	31 . .	31 . .	62
Rubber Research Institute . .	3 . .	50 . .	53
Penghulus	27 . .	— . .	27
Salaried Employees, Estates . .	3 . .	22 . .	25
Salaried Employees, Commercial . .	4 . .	20 . .	24
Private Enterprise, Agricultural . .	32 . .	5 . .	37
Private Enterprise, Non-agricultural . .	3 . .	5 . .	8
Total Employed . .	219	202	421
Total Died . .	8	9	17
Total Untraced . .	40	28	68
GRAND TOTAL . .	267	239	506

(X) GENERAL.

512. The Acting Principal attended meetings of the Central Advisory Committee on Education. Also he was present at the Inaugural Ceremony of the University of Malaya as a member of the University Court.

2.—DEPARTMENTAL OVERSEAS SCHOLARSHIPS.

513. Departmental Overseas Scholarships are awarded by the Federal Government to provide overseas higher education for suitable members of the locally-domiciled staff so that they may eventually be equipped to fill senior officer posts in the Department.

514. Applications for Departmental Scholarships are received by the Director of Agriculture and the candidates are interviewed by a Departmental Scholarships Selection Committee of which the Director of Agriculture is the Chairman. The Committee's recommendations are forwarded for the approval of the Federal Government.

515. These scholarships provide the selected candidates with free tuition, maintenance and transport. The majority of the scholars proceed to universities in the United Kingdom where arrangements for their academic training and other facilities are made by the Director of Colonial Scholars.

516. During the year the Departmental Scholarships Selection Committee selected one candidate to proceed to the United Kingdom for study in the academic year starting in October, 1950. This selection brings the total number of Departmental Overseas Scholars to four.

* Includes 1 in North Borneo, 10 in Brunei and 3 in Sarawak. † Includes 1 in North Borneo, 3 in Brunei and 9 in Sarawak.

517. The Federal Government has ruled that, in order that the standard of scientific officer recruited to the Department should not be lowered, these scholars should, on the attainment of their University degrees, proceed to post-graduate probationer training on the lines of selected expatriate graduates. Arrangements are being made for this probationer training.

D.—Publications and Library.

1.—PUBLICATIONS.

518. The principal publications of the Department are *The Malayan Agricultural Journal*; Special Bulletins (General, Scientific, and Economic Series); three vernacular agricultural journals, i.e., *Warta Perusaha-an Tanah*, *Ma Loy Chow Nung Nyip Tsung Poh* and *The Tamil Agricultural Journal*; and Agricultural Leaflets.

519. The Agricultural Economist, who is the Editor of *The Malayan Agricultural Journal* and also of the three vernacular journals, has the advice and guidance of the Publicity Committee of the Department, of which he is a Member and Secretary, and of the Sub-Committee for Vernacular Publications of which he is Chairman.

520. Owing to printing difficulties and lack of funds no issues of the vernacular journals were published during the year.

521. Publication of *The Malayan Agricultural Journal* was continued on a quarterly basis, and four issues were published during the year. The price of the Journal was increased in 1949 from 50 cents to \$2 per copy in view of the considerable increase in printing costs. The annual subscription is now therefore \$8 post free in Malaya. All estates and agency houses were circularised at the beginning of 1949, as a result of which 283 new subscribers to the Journal were registered.

522. Following the precedent of 1948, a Special Mechanization Number of the Journal was issued in July. This was a large number of 146 pages, containing twelve articles reporting the results of the investigational work of the Department with mechanical equipment. Two further important articles on mechanization appeared in the October issue and a Quarterly Progress Report on Mechanization was published in each issue of the Journal.

523. During the year a new quarterly report was introduced in the Journal entitled "Notes on Current Investigations". This report reviews the progress of research work, and records new investigations and work commenced.

524. The following two Special Bulletins were published during the year:

Malayan Food Composition Table, Scientific Series, No. 23.
Malayan Agricultural Statistics, 1947. Economic Series No. 13.

525. The 1948 edition of Malayan Agricultural Statistics was placed with the printer during the year but printing was not completed before the end of the year.

526. Similarly, a Special Bulletin in the General Series, No. 32, "The Pineapple Industry of the Hawaiian Islands", by Mr. F. C. Cooke, although placed with the printer early in the year was not completed until January, 1950.

527. A new leaflet on cocoa, Agricultural Leaflet No. 27, a reprint of a leaflet on groundnuts (No. 4), and a reprint of a leaflet in Jawi on the black beetle (No. 39) were published during the year.

528. The following is a summary of all publications of the Department printed in 1949, together with the number of copies sold or issued free.

ENGLISH.	Sales.	Free and Exchange.	Total.
MALAYAN AGRICULTURAL JOURNAL—			
Vol. 32, No. 1	640	777	1,417
Vol. 32, No. 2	649	800	1,449
Vol. 32, No. 3	736	821	1,557
Vol. 32, No. 4	535	767	1,302
			5,725
LEAFLETS (<i>Printed</i>)—			
1. Cocoa.			
Agricultural Leaflet No. 27	-	500	500
(<i>Reprinted</i>)—			
2. Groundnuts.			
Agricultural Leaflet No. 4	-	34	34
SPECIAL BULLETINS (<i>Printed</i>)—			
1. Malayan Food Composition Table.			
Scientific Series, No. 23	17	336	353
2. Malayan Agricultural Statistics, 1947.			
Economic Series, No. 13	84	295	379
MALAY.			
LEAFLET (<i>Reprinted</i>)—			
1. Black Beetle, No. 39 ..	-	1,492	1,492

529. The following summary shows the number of back numbers of the various publications of the Department distributed during 1949.

	Sales.	Free and Exchange.	Total.
Malayan Agricultural Journal ..	351 ..	447 ..	798
Special Bulletins	41 ..	66 ..	107
Agricultural Leaflets	8 ..	1,177 ..	1,185
Poultry Leaflets	2 ..	283 ..	285
Grow More Food and Educational Series	1 ..	109 ..	110
Malay Agricultural Journal ..	16 ..	915 ..	931
Leaflets in Malay	— ..	10,443 ..	10,443
Chinese Agricultural Journal ..	13 ..	5,967 ..	5,980
Leaflets in Chinese	— ..	28 ..	28
Tamil Agricultural Journal ..	— ..	1,347 ..	1,347
Leaflets in Tamil	— ..	1,118 ..	1,118
			22,332

530. The following is a summary of all publications sold and distributed during the year:

	Sales.	Free and Exchange.	Total.
English	3,064	6,412	9,476
Malay	16	12,850	12,866
Chinese	13	5,995	6,008
Tamil	—	2,465	2,465
	3,093	27,722	30,815

531. Comparative figures for total revenue received during 1948 and 1949 from the sale of publications and from advertisements are as follows:

	1948.	1949.
	\$ c.	\$ c.
Sale of publications ..	1,108 35	5,914 62
Advertisements	1,502 50	2,081 13
	2,610 85	7,995 75

2.—LIBRARY.

532. The Library now contains about 3,050 books and reports published in book form, and nearly 27,800 bound volumes of periodicals in addition to approximately 1,000 unbound volumes, most of which are of earlier years and incomplete. The Library also contains many thousands of pamphlets and reprints. Approximately 1,270 periodicals are available.

533. Periodicals purchased and received in exchange during the year totalled 101 and 360 respectively; the total number of these periodicals received was 5,097. A total of 33 books was purchased; 220 volumes of periodicals were bound.

534. Total expenditure during the year on the purchase of publications amounted to \$2,245.85; \$492.80 was spent on translations, and \$1,991.27 was spent on the upkeep of the Library.

E.—Schemes Sponsored under the Colonial Development and Welfare Act (U.K.).

1.—SCHEMES FINANCED FROM THE MALAYAN ALLOCATION.

535. Brief particulars are given here of development schemes in progress under the control of the Department of Agriculture, Federation of Malaya. Further particulars are given in Section IV—Work of the Department of Agriculture.

536. *Schemes D. 698, 698A and 698B*—These schemes are for the purpose of appointing an Adviser to the Malayan Pine-apple Industry for the immediate administration of the rehabilitation, re-organization and development of the Industry. The grants approved under these schemes were £1,320 (\$11,314.27), £5,600 (\$48,000), and £500 (\$4,285.71) respectively to meet the salaries, office expenses and passages of the Adviser appointed at first for one year from 20th December, 1946, then extended to two years and further extended to cover his period of leave up to 30th April, 1950.

537. It has been considered necessary to retain, at the expiry of his leave, the services of the Adviser for a further period of three years and the Central Board of Pineapple Packers, Malaya, has agreed to contribute half the expenses during the period, the other half to be met from a further grant to be obtained from the Colonial Development and Welfare Funds.

538. *Scheme D. 669.*—A grant of £38,000 (\$325,714) was made in June, 1946, for conducting experiments on mechanization of wet padi cultivation in Malaya.

539. The grant was specifically for meeting capital expenditure on machinery but later amended to include expenses in connection with the appointment of an agricultural mechanization expert for about two years and the cost of publication of the results of mechanization experiments in Malaya.

540. *Scheme D. 1176.*—A grant of £121,786 (\$1,043,875) was approved for a scheme for the provision of improved rubber planting material to smallholders and for the training of selected youths from smallholdings in all aspects of rubber cultivation so that they will form a nucleus of instructed individuals.

541. The scheme which is designed to cover a period of five years, is administered in co-operation with the Rubber Research Institute of Malaya.

542. The scheme was financed from the Colonial Development and Welfare grant with effect from 1st August, 1949. Pending approval of the grant certain preliminary expenses on the scheme incurred prior to 1st August, 1949, were met from a grant of \$124,000 from the Malayan Rubber Fund.

543. *Scheme D. 1220.*—A grant of £10,500 (\$89,930) was approved for the establishment and maintenance for a five-year period of an Isolation Nursery for Cocoa at Pulau Tekong, Singapore.

544. This Station is intended to serve the phytosanitary needs of British South East Asian territories in their imports of selected cocoa planting material.

545. This scheme is intended to lay the foundation for the development of a cocoa industry and to be a step for the diversification of commercial agriculture in the region of British South East Asia.

2.—SCHEMES FINANCED FROM THE CENTRAL ALLOCATION.

546. Two schemes financed from the Central Allocation and administered by the Colonial Office were approved as follows:

547. *R. 362.*—A grant of £910 was approved to meet the expenses of a mission from the United Kingdom to advise on soil management and mechanization of wet padi cultivation in Malaya.

548. The two-man mission consisted of Dr E.W. Russell, a soil physicist at the University of Oxford and Mr J.C. Hawkins, an authority on ploughing and cultivation implements at the National Institute of Agricultural Engineering. They visited Malaya during July and August, 1949.

549. R. 319.—A grant was approved to meet the expenses of a two-man mission from the United Kingdom consisting of Mr. R. G. Simmons, C.B.E., Adviser on Animal Health to the Secretary of State for the Colonies and Dr A.E.S. McIntosh, Deputy Director of Agriculture, Federation of Malaya, then on leave in the United Kingdom, to enquire into the regional organisation of Agricultural, Veterinary and Forest Research in the Federation of Malaya, Singapore, Sarawak and North Borneo. They toured the territories concerned during the period April to July, 1949.

(F).—*Public Gardens, Kuala Lumpur.*

550. The policy of the Public Gardens, Kuala Lumpur, continued to be vested in a Public Gardens Committee, comprising eleven prominent citizens of Kuala Lumpur under the Chairmanship of the Director of Agriculture, who continued to be the administrative officer.

551. The Officer-in-charge, Public Gardens, retired in August, from which time the work of the Gardens has been supervised by the Personal Assistant to Director of Agriculture in addition to his normal duties. He, in collaboration with the Horticultural Assistant, acted in an advisory capacity on gardening and several cyclostyled leaflets on garden plants and gardening procedure were published and distributed free to enquirers.

552. The Gardens were maintained in a very satisfactory condition throughout the year, new varieties of ornamental plants were introduced and the stock of plants in the propagation sheds was materially augmented. The Gardens have become increasingly popular as has been demonstrated by the ever growing number of visitors.

553. The Horticultural Assistant continued to supervise the upkeep of the grounds of King's House and Carcosa.

554. Sales of planting material to the public for the year amounted to \$3,910.

555. Negotiations continue in the matter of transfer of the administration of the Public Gardens from the Department of Agriculture to the Kuala Lumpur Municipality.

556. In the Experimental Plantation adjacent to the Public Gardens, small-scale trials with imported types of vegetables, ramie seed from Australia, soya beans and maize were made by the Botanical Division, while the Chemical Division carried out experiments on composting and the Plant Pathological Division experiments on the control of bacterial wilt disease of tomatoes.

SECTION V.

AGRICULTURAL COMMITTEES.

1.—ADVISORY COMMITTEE OF THE DEPARTMENT OF AGRICULTURE.

557. The Advisory Committee comprised the following members:

The Honourable the Director of Agriculture (*Chairman*)

The Honourable the Financial Secretary

The Director of Forestry
 The Director, Drainage and Irrigation Department
 The Director of Veterinary Services
 The Director of Co-operation
 The Director, Rubber Research Institute of Malaya
 The Honourable Mr W. A. Gordon Hall
 The President, United Planting Association of Malaya
 The Honourable Col. H. S. Lee, C.B.E., J.P.
 His Highness Tengku Yaacob ibni Al-marhum Sultan
 Abdul Hamid, C.M.G.
 Mr A. C. Smith, Bagan Datoh, Perak
 Mr P. A. Rogers, Kuala Lumpur
 Mr J. H. Clarkson, Kuala Lumpur
 The Honourable Tuan Sheikh Ahmad bin Sheikh
 Mustapha, C.B.E., J.P., M.C.H.
 The Deputy Director of Agriculture
 The Chief Research Officer
 The Chief Field Officer
 The Personal Assistant to Director of Agriculture
 (*Secretary*).

558. It was not found possible to hold a meeting during the year on account of the acute shortage of Department senior staff and the frequent changes in acting holders of the appointments of Director of Agriculture, Deputy Director of Agriculture and Chief Field Officer caused by retirement and leave incidence.

2.—ADVISORY COUNCIL OF THE COLLEGE OF AGRICULTURE.

559. This Council consisted of:

The Honourable the Director of Agriculture (*Chairman*)
 The Director of Co-operation
 The Director of Veterinary Services
 The Principal, Sultan Idris Training College, Tanjong
 Malim
 The Director, Rubber Research Institute of Malaya
 The President of the United Planting Association of
 Malaya
 The President of the Malayan Estate Owners' Association
 Mr P. A. Rogers, M.A., Kuala Lumpur
 The Principal, College of Agriculture
 Che Mohamed Rashid bin Ahmad (Old Boys' Association)
 The Personal Assistant to the Director of Agriculture
 (*Secretary*).

560. A meeting of the Council was held on 2nd December, 1949, at which the following matters were considered: Development and expansion of the College and the building of additional hostel accommodation; the number and method of allocation of scholarships during the 1950/51 academic year; the employment of trainees after leaving the College; re-introduction of three-year diploma course and syllabus therefor.

3.—MISCELLANEOUS COMMITTEES.

561. The Director of Agriculture or his representative served on the following additional Boards and Committees during the year:

- Board of the Rubber Research Institute
- Smallholders' Advisory Committee
- Planters' Loans Board
- Public Gardens Committee
- Advisory Committee on Fauna and Flora
- Nutrition Advisory Board
- Malaria Advisory Board
- The Rubber Smallholdings Enquiry Committee
- Departmental Scholarships Selection Committee
- Departmental Committees:
 - (i) Standing Committee on Investigations
 - (ii) Appointments Committee
 - (iii) Publicity Committee
 - (iv) Examinations Board.

SECTION VI.

AGRICULTURAL LEGISLATION.

562. Legislation as summarised below was passed during 1949:

1.—PROHIBITION OF IMPORT ORDERS, 1946.

563. The prohibition of the import of "Plants of all species" was amended by the addition of the words "including cut flowers". Legal Notifications 253 and 254 of 4th June, 1949.

564. The importation by air of live poultry and fresh eggs was also prohibited. Legal Notification 633 of 30th December, 1949.

2.—EXPORT OF RUBBER BUDWOOD OR SELECTED SEEDS.

565. Exemption was granted from the provisions of the Rubber Regulation Enactment/Ordinance of the F.M.S., Johore and the Straits Settlements respectively which prohibit the export of rubber planting material outside the Federation of Malaya. Under this exemption rubber budwood or selected seeds may now be exported to Commonwealth countries outside the Federation of Malaya on a permit to be obtained from the Controller of Rubber, Malaya, and subject to fulfilment of the following conditions to the satisfaction of the Controller:

- (i) that the permit is returned to the Controller within one month from the date of issue thereof duly endorsed by the person to whom such budwood or seeds are consigned;
- (ii) that the country to which the budwood or selected seeds are to be exported has either made arrangements or has given a general assurance for the reciprocal importation from such country into the Federation of other types of valuable planting material, whether rubber or other economic crops, should the same be required; and

(iii) that the person to whom such budwood or selected seeds are to be exported has given an assurance that such budwood or selected seeds will not be re-exported from the country to which they are exported from the Federation. Legal Notifications 355 and 356 of 30th August, 1949.

566. The Director of the Rubber Research Institute, Malaya, has been permitted to export rubber budwood or selected seeds to the Centrale Proefstation Vereniging, Java, subject to the conditions stated above. Legal Notification 495 dated 7th October, 1949.

3.—THE POISONS (SODIUM ARSENITE) ORDINANCE, 15/1949.

567. This Ordinance was enacted in order to provide for the regulation and control of the importation, sale and use of sodium arsenite. The regulations—Legal Notification 92 dated 7th March, 1949, as amended by Legal Notification 622 dated 24th December, 1949—passed under this Ordinance provide, among other things, for the control of the sales as well as purchases of sodium arsenite for agri-horticultural purposes and require that any person employed in the handling or spraying operations shall be medically examined at the beginning and conclusion of such operations.

568. Sodium arsenite is widely used in the eradication of weeds in agricultural operations and the Ordinance and the regulations thereunder, therefore, constitute necessary safeguards for the protection of human and animal life from dangers resulting through carelessness in the handling, storage and transportation of this chemical.

A. E. S. McINTOSH,
*Acting Director of Agriculture,
Federation of Malaya.*

APPENDIX I.
COMPARATIVE ACREAGES OF AGRICULTURAL CROPS.

	1939. Acres.	1940. Acres.	1946. Acres.	1947. Acres.	1948. Acres.	1949. Acres.
Rubber	3,372,966	3,412,084	3,215,250	3,317,299	3,362,525	3,365,460
Oil Palm	75,825	78,256	77,458	78,181	83,320	90,507
Coconut	599,135	600,882	—	512,086	510,824	499,610
Padi (Rice) ..	746,720	785,450	789,650	813,550	885,484	908,070
Total	4,794,646	4,876,672	4,082,358	4,721,116	4,842,153	4,863,647
FOODCROPS :						
Tapioca	36,146	46,292	58,711	41,807	41,693	41,341
Sweet Potato ..	10,052	12,366	22,483	20,363	21,619	18,922
Sago	6,728	6,976	6,385	6,556	6,693	6,738
Sugar Cane .. .	1,287	3,251	9,261	4,541	3,297	2,346
Groundnut .. .	2,537	2,054	1,951	2,300	1,556	1,027
Maize	3,489	8,369	2,059	1,107	1,117	806
Yam	1,524	1,859	1,066	870	836	621
Colocasia .. .	470	2,938	4,342	3,627	3,711	3,354
Ragi	—	181	1,389	451	72	37
Soya Bean .. .	30	188	238	145	186	63
Pulses	—	—	599	487	854	548
Vegetable (Market Gardens) .. .	19,946	25,406	17,346	15,019	15,205	13,167
Total Foodcrops ..	82,209	109,880	125,830	97,273	96,839	88,970
FRUITS :						
Pineapple .. .	64,555	60,157	13,813	11,920	16,082	17,239
Banana	35,107	45,728	67,995	64,075	59,950	57,629
Papaya	299	503	622	306	416	392
Cashew Nut .. .	1,784	793	1,727	1,512	2,219	2,049
Specified Fruits ..	4,575	4,014	17,060	20,430	25,288	32,914
Mixed Fruits .. .	67,446	73,843	70,693	82,997	85,348	77,264
Total Fruits .. .	173,766	185,038	171,910	181,240	189,303	187,487
SPICES :						
Arecanut .. .	63,524	58,619	51,579	50,983	50,194	48,957
Chillies	2,252	2,952	2,692	3,189	3,159	2,490
Pepper	222	203	85	80	75	80
Cardamom .. .	27	—	5	8	7	5
Ginger	1,257	1,569	1,332	1,358	1,562	1,447
Sireh	2,716	2,955	2,317	2,308	2,418	2,438
Nutmeg	93	112	21	53	87	70
Cloves	386	398	281	239	288	293
Turmeric .. .	9	687	1,018	1,085	1,174	1,120
Total Spices .. .	70,486	67,495	59,330	59,353	58,964	56,900
MISCELLANEOUS :						
Tea	7,043	8,898	8,697	9,732	9,516	9,413
Coffee	20,589	16,522	9,839	8,958	7,047	9,507
Tobacco	5,440	5,857	3,699	4,266	1,294	1,457
Derris	6,594	5,481	1,193	772	234	264
Nipah	27,945	27,074	30,115	32,074	27,238	33,438
Gambier .. .	2,925	4,000	523	518	387	532
Kapok	2,460	2,353	1,861	1,852	1,814	1,770
Ipecacuanha ..	—	—	678	678	678	257
Patchouli .. .	292	945	178	501	109	32
Citronella .. .	25	122	32	88	33	20
Gutta Percha ..	2,890	3,890	5,054	5,635	5,635	5,635
Other Miscel- laneous .. .	580	287	7,564	645	508	753
Total Miscellaneous ..	76,783	75,429	69,433	65,719	54,493	63,078
TOTAL ALL CROPS ..	5,197,890	5,314,514	4,508,861	5,124,701	5,241,752	5,260,082

